

# **INVENTORY OF FREIGHT TRANSPORTATION IN THE SOUTHWEST/PART I: MAJOR USERS OF TRANSPORTATION IN THE DALLAS-FORT WORTH AREA**

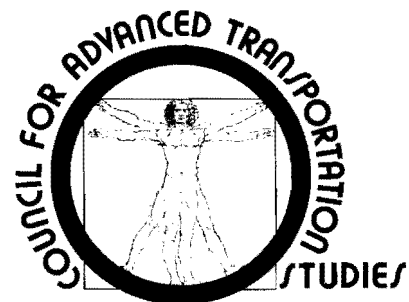
EUGENE ROBINSON

## **RESEARCH REPORT 4**

DECEMBER 1973



**DEPARTMENT OF TRANSPORTATION  
OFFICE OF UNIVERSITY RESEARCH  
WASHINGTON, D.C. 20590**



**The University of Texas at Austin**

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RESEARCH REPORT

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16. Abstract  <p>This report presents an inventory of the existing facilities, services, and practices of major shippers and distributors in the Dallas-Fort Worth area. A comparison of regional and national earnings by broad industrial sector demonstrates the relative significance of particular industry segments on the general economic conditions of the area.</p> <p>Data presented for various manufacturing industries were analyzed in order to determine the market destinations for specific commodities and the mode of shipment selected by the shipper or distributor.</p> <p>Personal interviews with 41 major users of transportation (representing a cross-section of manufacturers and nonmanufacturers in the Dallas-Fort Worth area) revealed the existence of a complex and intricate distribution system. Included in the inventory is information on daily and seasonal fluctuations in volume, variation in fleet size, variation in warehouse capacity, and patterns of goods movement.</p> <p>The results of this study indicate a growing dependence on the use of motor carriers for freight movements, with nearly two-thirds of all establishments surveyed operating their own private carrier fleet.</p>			
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## EXECUTIVE SUMMARY

### Introduction

This is the first of a series of four reports covering existing freight transportation facilities, services, and practices in the Dallas-Fort Worth economic area. The report provides information on the major users of freight transportation in the area.

### Problem Studied

The problem studied by the research effort under which this report was produced is that of determining ways in which freight transportation in the Southwest may be improved. Improvement of freight transportation in the Southwest is the goal of the research effort. The approach to this goal has been (1) to examine the existing freight transportation system, (2) to develop forecasts of the future demands on the system, and (3) to develop recommendations for the improvement of the freight transportation system. In order to provide for detailed examination of transportation problems, an intensive study area surrounding Dallas and Fort Worth was selected within the four-state overall study area. This report presents the results of the examination of one component of the freight transportation system in the Dallas-Fort Worth area.

### Results Achieved

This report presents an inventory of the major users of freight transportation service in the Dallas-Fort Worth area. The second report in the series covers motor common carrier service in the area. The third report in the series covers air freight service, and the fourth report will cover rail freight transportation service.

The industrial profile of the Dallas-Fort Worth area has changed significantly since World War II. Prior to the war, manufacturing in the area was largely concentrated in relatively few categories of the Standard Industrial Classification. During the postwar period, there has been a substantial increase both in the number of manufacturers in the area and in their diversification. Nineteen of the twenty-one manufacturing major group classifications in the Standard Industrial Classification are now represented in the Dallas-Fort Worth area, whereas prior to World War II there were only sixteen represented. The total number of manufacturing establishments in the area has increased by 150 percent since the war.

Growth in the wholesale and retail trade sectors has paralleled the expansion of manufacturing in the Dallas-Fort Worth area. Dallas now ranks as one of the major marketing centers in the United States. Many firms have chosen locations for distribution centers in industrial parks. The changes in economic activity and land use have had a significant impact on the transportation system of the region.

Data for this report were gathered by a survey of 41 major users of transportation selected from the 3,184 manufacturing units in the Dallas-Fort Worth area. Secondary data sources used included the 1967 Census of Transportation and recent editions of County Business Patterns. For purposes of analysis and confidentiality individual manufacturers and distributors were aggregated into groups having similar characteristics. The following are representative major categories in the Dallas-Fort Worth area:

Food and Kindred Products. The 1967 Census of Transportation indicates that trucks (both common carrier and private) transport about 72 percent of the outbound shipments of food and kindred products from the Dallas-Fort Worth area with the remainder moving largely by rail. The survey findings indicate that eight out of nine manufacturers use various multimodal combinations of rail and truck transportation and some use other modes. Inbound traffic exhibits different geographic and modal characteristics. Raw materials are received from many areas of the United States but the distribution of finished products is concentrated in the West South Central states.

Fabricated Metal Products. The 341 fabricated metal products manufacturing units located in the Dallas-Fort Worth area account for seven percent of the outbound manufactured freight tonnage of the area. The 1967 Census of Transportation reports that private trucks were the primary transportation mode used by the firms. The units surveyed exhibited variations ranging from use of rail for most inbound and about half of outbound traffic to almost exclusive use of trucks.

Apparel and Fabricated Textile Products. The apparel manufacturing industry is represented by 227 manufacturing units in the study area, but because of the nature of its product, produces only about .4 percent of the area outbound manufactured tonnage. The 1967 Census of Transportation indicates that about two-thirds of the apparel traffic moves by common carrier truck with much of the rest moving in private carriage. The survey indicated a significant use of package express service for outbound traffic.



Machinery (except electrical). The nonelectrical machinery industry has the largest number of units (468) of the manufacturing major groups, but accounts for less than two percent of the outbound manufactured tonnage. Most of the freight was handled by motor common carriers and is shipped to points within the West South Central states.

#### Utilization of Results

This inventory of major users of transportation and the other components of the inventory of transportation facilities, services, and practices in the Dallas-Fort Worth area should be useful to transportation planners, providers and users of transportation service and those contemplating such activity in the future, and to those with an interest in the economy of the area. The inventory should also be useful to researchers conducting similar studies for other geographic areas.

#### Conclusions

The report is indicative of a continuing trend toward increasing use of motor transportation and of private carriage. Approximately two-thirds of the establishments surveyed operated private truck fleets. Manufacturers and distributors in the area rely on motor common carriers and railroads more for inbound shipments than for outbound. Long-distance outbound shipments tend to move by motor common carrier and by rail. Many of the outbound shipments from the area are made in less-than-truckload quantities. A preference for contract carriers was expressed by several survey respondents.

## PREFACE

This report is an inventory of the existing freight transportation facilities, services, and practices of major shippers and distributors in the Dallas-Fort Worth area. The research findings from this report and other reports developed under a multidisciplinary transportation research project will be used in formulating recommendations for improving intermodal freight transportation in the Southwest.

This is the first in a series of reports describing the work in Research Project DOT-OS-30093, entitled "Transportation to Fulfill Human Needs in the Rural/Urban Environment." Topics being developed are: I. Access to Essential Services; II. Influence on the Rural Environment of Interurban Transportation Systems; III. Transportation Development in the Southwest with Emphasis on Intermodal Freight and the Dallas-Fort Worth Airport; IV. Ride Quality Evaluation in Multimodal Systems; and V. Human Response in the Evaluation of Modal Choice Decisions.

This is the first report in a series that deals directly with the inventory of freight transportation in the Southwest. Subsequent reports concerning the improvement of intermodal freight transportation in the Southwest will be submitted as they are completed.

The facilities and resources of the Bureau of Business Research at The University of Texas at Austin were utilized in the preparation of this report. The research was supervised by Dr. Stanley A. Arbingast, Professor of Resources and Director of the Bureau of Business Research, Dr. Hampton K. Snell, Professor of Transportation, and Charles P. Zlatkovich, Research Associate and Transportation Specialist.

The author was assisted in data collection by Research Associates Charles W. Adams, J. Bryan Adair, and James S. Wilson. This report was edited and prepared for publication by Kathleen Luft. Typing was done by Jewell White. Offset printing was the work of Robert Dorsett and Daniel Rosas, assisted by Robert Jenkins and Salvador Macias.

Eugene Robinson

December 1973

The contents of this report reflect the view of the author, who is responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Department of Transportation. This report does not constitute a standard, specification, or regulation.

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## CHAPTER I

### INTRODUCTION

#### Research Objectives

The impetus behind this report is a desire to improve intermodal freight transportation in the Southwest. This concern for improving our intermodal transportation system is not premature, given the energy crisis this nation faces. There is a great need to explore ways of conserving our resources while still maintaining services at their present level.

The aim of this interim report is to present an up-to-date picture of the transportation facilities, services, and practices of major shippers and distributors in the Dallas-Fort Worth area.

The most meaningful way to view the practices and services offered by each shipper and distributor making up the transportation system or network in an area, is over time and simultaneously. In this report the data presented represent the daily, weekly, monthly, or seasonal and yearly activity of the businesses surveyed.

The ability to understand what is occurring in an area at any given time is important in assessing the transportation problems that exist in an area and in formulating solutions. With this type of information, bottlenecks, duplication, and other inefficiencies may be discovered.

#### History of Industrial and Trade Expansion in the Study Area

In an assessment of the transportation needs and requirements of a community or an area, the factors that give rise to the situation must also

be analyzed. The factors that are important determinants of the transportation system that prevails (or fails to exist) in an area are the type, number, and complexity of industrial and trade operations in that area.

The extent to which the leaders and other decision-makers of a community are aware of the present and future transportation needs of its industrial and trade sectors helps determine how that community fares economically and socially. In this section attention will be directed at industrial and trade expansion in the Dallas-Fort Worth study area. All relevant changes in the makeup, technology, or location of the various industrial and trade operations will be analyzed.

In this analysis of industrial development in the study area, World War II has been utilized as an arbitrary reference point because of the difference in the makeup and complexity of the industrial community before and after that period.

Prior to World War II, approximately 40 percent of the largest manufacturers were already established.<sup>1</sup> These manufacturers engaged basically in the following types of activity: (1) 15.6 percent food and kindred products, (2) 14.3 percent apparel and other products made of fabric, (3) 13 percent metal fabrication (except transportation equipment), (4) 20.7 percent machinery (except electrical). The remaining 37.1 percent covered activities that ranged from chemicals and allied products (1.3 percent) to electrical and electronic products and supplies (6.5 percent).

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<sup>1</sup>In this section on industrial development, when statistics are given on the largest manufacturers, unless otherwise specified, reference is made to the 176 largest manufacturers listed by the Bureau of Business Research (University of Texas-Austin) in the Directory of Texas Manufacturers, which contains data on these establishments.

During the years following World War II, 60 percent of the largest manufacturers came into existence, dramatically changing the industrial profile of the area. This change is evident in the increase in the number of manufacturers and in the diversification of their activities. Prior to World War II, only sixteen of the twenty-one SIC-designated industries existed in the area; since that time the number has increased to nineteen. Since World War II, there has occurred a 150-percent increase in the total number of manufacturers.

During the postwar period moderate to substantial increases occurred in manufacturers entering certain industries. The study area saw three new industries engage in the manufacture of the following: (1) lumber and wood products (except furniture), (2) stone, clay, glass, and concrete, and (3) rubber and miscellaneous plastic products. The numbers of manufacturers in the following classifications before and after World War II reflect moderate to substantial increases; (1) 1 to 7 units--chemicals and allied products, (2) 5 to 14 units--electrical and electronic machinery, supplies, and equipment, (3) 1 to 23 units--transportation equipment, and (4) 1 to 10 units--measuring, analysing controlling, and photographic and optical devices. At no time during this period was there an absolute decrease in the number of units in a particular industry.

The Bureau of Business Research, The University of Texas at Austin, in its Directory of Texas Manufacturers for 1973, lists 3,184 manufacturers in the Dallas and Fort Worth SMSA's, which are contained in the intensive study area. At the present time the largest manufacturers are engaged in the following: (1) 17.8 percent machinery (except electrical), (2) 12.4 percent apparel and other products made of fabrics, (3) 7 percent food and kindred products, (4) 12 percent fabricated metal products, (5) 10 percent transportation equipment and (6) 4.5 percent miscellaneous manufacturing.



Within the last ten years the land use pattern in most of the study area has changed dramatically. According to a report released in 1971 (Dallas-Fort Worth Regional Transportation Study) a total of 27,243 acres were utilized as industrial parks (districts) in Dallas and Tarrant counties. During 1964, 15,793 acres were utilized by various types of manufacturers in Dallas and Tarrant counties, but the development was in the form of isolated sites. Since 1964 manufacturers have recognized the value of multiunit development programs and have vigorously pursued them. Since that time 79 industrial parks (districts) have been developed in Dallas County and 38 in Tarrant County.

The growth and expansion of the wholesale and retail trade sector strongly parallels that of the manufacturing sector. Immediately following U.S. disengagement from World War II, wholesale and retail trade was revitalized. By 1971 13,047 wholesale and retail establishments were found in the study area.

Much like manufacturers, many of these wholesale and retail establishments are choosing locations in industrial parks. This trend is particularly strong among those wholesaling establishments that serve as distribution centers. Because Dallas ranks as one of the leading trade and marketing centers, conscious efforts have been made to assure that these centers are adequately served by strategically locating them near major transportation arteries.

In the recent history of industrial development in the study area, two things are salient--the rapidity of the industrial development process and diversification after World War II, and the change in land use in the last few years. In inventorying and evaluating the existing freight facilities in the study area, a great amount of attention must be given to the location and concentration of major users of transportation.

### General Economic Conditions in the Study Area

In an assessment of the economic viability of a community, region, or state, one of the most important considerations is personal income. The components of personal income (earnings, property income, and transfer payments less contribution to social insurance) and the significance of each in its calculation indicate the main economic forces at work in an area.

The relevance of this type of economic data in a report on the facilities and practices of major users of transportation in an area derives from the fact that it explains why many of these things exist.

Basically, growth in the industrial and trade sectors was predicated on the general improvement of the economic well-being of the populace. As industry and trade expand, the general economic well-being of the community improves, and this in turn is a stimulus for further expansion; a circular process is at work.

In this report earnings from broad industrial sectors will be analyzed for three areas: the twenty-four county study area,<sup>2</sup> Dallas County, and Tarrant County. Emphasis is placed on Dallas and Tarrant counties because most of the economic activity in the intensive study area occurs there. The earning data for these areas will be compared with U.S. data.

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<sup>2</sup>In the original research proposal submitted to the Department of Transportation the twenty-six counties designated by the Regional Economic Division of the Office of Business Economics was selected as the overall study area; earnings data presented in this report applies only to the twenty-four counties in Texas (Figure 1 shows the overall study area and the intensive study area).

All state and regional income data presented in this report were obtained from data tapes acquired from the Regional Economic Division of the Office of Business Economic by the Bureau of Business Research at The University of Texas at Austin. National earnings data presented came from a report by the Bureau of Economic Analysis, Department of Commerce, for the Environmental Protection Agency's Water Quality Management Planning Group.

#### Growth in personal income

Personal income growth for the twenty-four county region and for Dallas and Tarrant counties exceeded the U.S. rate for a comparable period. Personal income in the United States for the period extending from 1968 to 1970 has been increasing at an average annual rate of 2.3 percent. For the same period, personal income for the twenty-four county region was growing at an average annual rate of 6.5 percent. During 1968-1970 the average annual rate of increase in personal income was 7 percent for Dallas County and 5.3 percent for Tarrant County.

Three tables have been prepared to summarize earnings data for the twenty-four county region and for Tarrant and Dallas counties.

#### Manufacturing earnings

28.0 percent of regional earnings  
27.7 percent of U.S. earnings

Manufacturing contributed a larger portion of income earned by workers in the twenty-four county region than any other industrial sector. Twenty-eight percent of the total earnings came from manufacturing units in the area; the comparable figure for the U.S. was 27.7 percent.

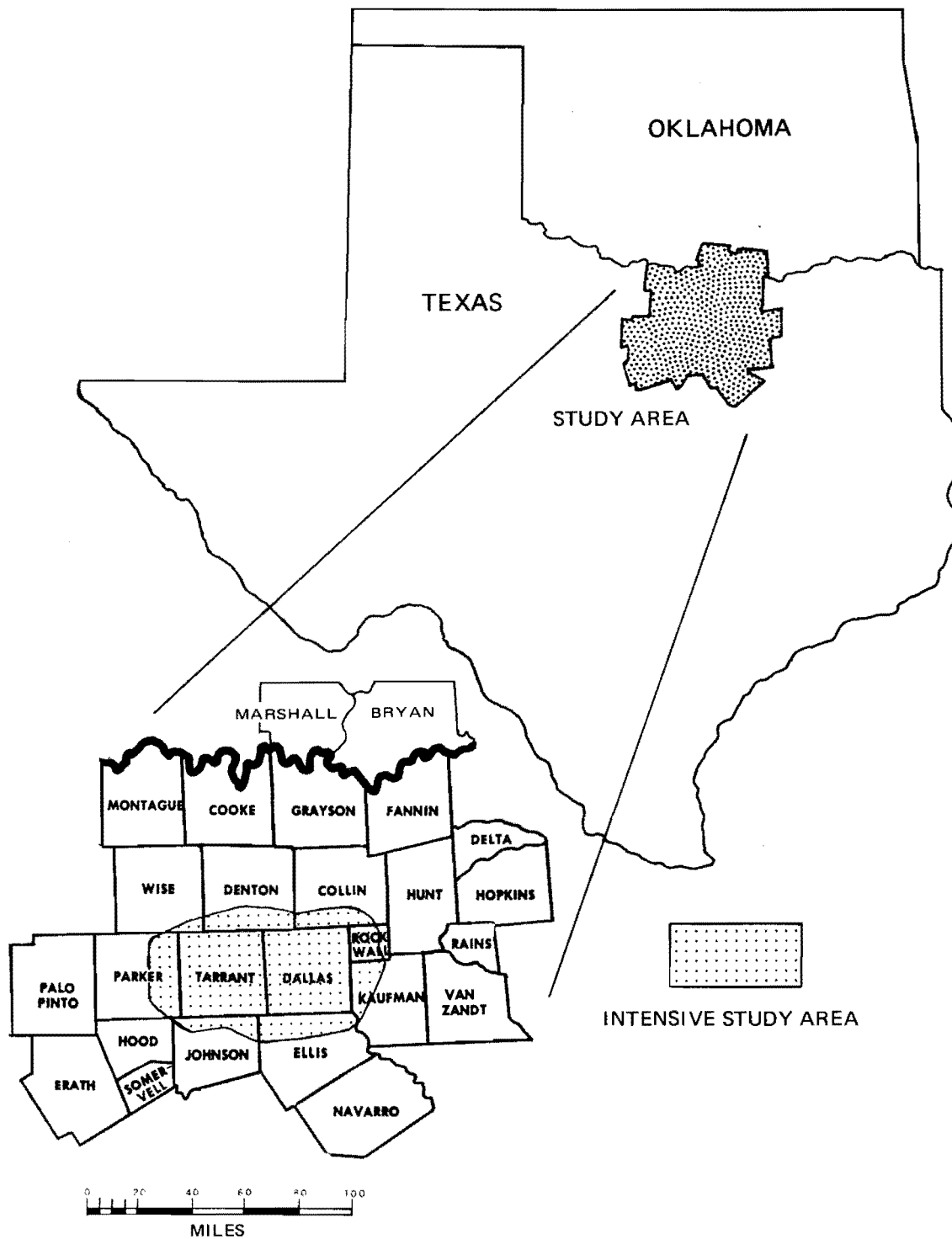


Figure 1

STUDY AREA AND INTENSIVE STUDY AREA

Table 1

## STUDY AREA\* AND U.S. EARNINGS BY BROAD INDUSTRIAL SECTOR, 1970

Sector	Amount (\$1,000)		Percent of total earnings	
	Regional	U.S.	Regional	U.S.
Government earnings				
Civilian government	927,062	84,120,212	10.5	15.0
Armed forces	151,803	14,984,272	1.7	2.7
Total government earnings	1,078,865	99,104,484	12.3	17.7
Farm earnings	110,031	18,549,767	1.3	3.3
Private nonfarm earnings				
Mining	142,010	5,819,015	1.6	1.3
Manufacturing	2,460,684	155,664,386	28.0	27.7
Transportation, communication, and public utilities	717,711	39,733,207	8.2	7.1
Wholesale and retail trade	1,816,372	93,266,904	20.7	16.5
Finance, insurance, and real estate	617,720	29,360,297	7.0	5.2
Services	1,324,060	85,174,919	15.1	15.2
Contract construction	492,303	34,149,358	5.6	6.1
Other	14,701		.2	
Total nonfarm earnings	8,683,803	443,160,080	98.7	79.0
Total	8,793,834	560,822,331	100.0	100.0

\* The study area consists of 26 counties (2 in Oklahoma and 24 in Texas); the figures in this table apply only to Texas counties.

Source: Regional Economics Division, Office of Business Economics, and Bureau of Economic Analysis, Department of Commerce, data were used in developing this table.

Table 2

## DALLAS COUNTY AND U.S. EARNINGS BY BROAD INDUSTRIAL SECTOR, 1970

Sector	Amount (\$1,000)		Percent of total earnings	
	Dallas	U.S.	Dallas	U.S.
Government earnings				
Civilian government	384,898	84,120,212	7.3	15.0
Armed forces	35,869	14,984,272	.68	2.7
Total government earnings	420,767	99,104,484	8.0	17.7
Farm earnings	2,698	18,549,767	.05	3.3
Private nonfarm earnings				
Mining	95,468	5,819,015	1.8	1.3
Manufacturing	1,337,876	155,664,386	25.4	27.7
Transportation, communication, and public utilities	520,978	39,733,207	9.9	7.1
Wholesale and retail trade	1,240,255	93,266,904	23.6	16.5
Finance, insurance, and real estate	472,395	29,360,297	8.9	5.2
Services	834,761	85,174,919	15.9	15.2
Contract construction	334,834	34,149,358	6.4	6.1
Other	6,874		.13	
Total nonfarm earnings	5,264,208	443,160,086	99.9	79.0
Total	5,266,906	560,822,337	100.0	100.0

Source: Regional Economics Division, Office of Business Economics, and Bureau of Economic Analysis, Department of Commerce, data were used in developing this table.

Table 3

## TARRANT COUNTY AND U.S. EARNINGS BY BROAD INDUSTRIAL SECTOR, 1970

Sector	Amount (\$1,000)		Percent of total earnings	
	Tarrant	U.S.	Tarrant	U.S.
Government earnings				
Civilian government	270,880	84,120,212	12.2	15.0
Armed forces	48,738	14,984,272	2.2	2.7
Total government earnings	319,618	99,104,484	14.4	17.7
Farm earnings	6,143	18,549,767	.23	3.3
Private nonfarm earnings				
Mining	26,139	5,819,015	.97	1.3
Manufacturing	820,760	155,664,386	30.5	27.7
Transportation, communication, and public utilities	105,741	39,733,207	4.7	7.1
Wholesale and retail trade	385,858	93,266,904	14.4	16.5
Finance, insurance, and real estate	108,967	29,360,297	4.0	5.2
Services	313,739	85,174,919	11.7	15.2
Contract construction	105,741	34,149,358	3.9	6.1
Other	2,317		.1	
Total nonfarm earnings	2,208,812	443,160,086	99.7	79.0
Total	2,214,955	560,822,337	100.0	100.0

Source: Regional Economics Division, Office of Business Economics, and Bureau of Economic Analysis, Department of Commerce, data were used in developing this table.

#### Wholesale and retail trade earnings

20.7 percent of regional earnings  
16.5 percent of U.S. earnings

Wholesale and retail trade establishments contributed 20.7 percent of total earnings in the region, 4.5 percentage points higher than the U.S. figure. The significance of wholesale and retail trade as income generators in the region may be attributed to the presence of such large marketing and trade centers as Dallas and Fort Worth, which act as regional as well as local distribution centers.

#### Service earnings

15.1 percent of regional earnings  
15.2 percent of U.S. earnings

The service industry, the third-largest contributor to total earnings in the region, was responsible for 15.1 percent of the regional earnings. This industry contributed 25.7 percent more in 1970 than in 1968 to the income of its workers.

#### Government earnings

12.3 percent of regional earnings  
17.7 percent of U.S. earnings

Earnings from government--local and federal--played less of a role in the region than in the United States on an average. Regional earnings from government amounted to 12.3 percent of the total, which was 5.4 percentage points below the U.S. figure.

#### Transportation, communication, and public utilities earnings

8.2 percent of regional earnings  
7.1 percent of U.S. earnings

Transportation, communication, and public utilities were slightly larger contributors to earnings at the regional level than nationally. This sector



generated 8.2 percent of the regional earnings and 7.1 percent of the U.S. earnings. This difference may be partially attributed to the tremendous transportation requirements generated by the marketing and trade centers located in the region.

Finance, insurance, and real estate earnings

7.0 percent of regional earnings  
5.2 percent of U.S. earnings

The finance, insurance, and real estate industry earnings figure is tremendously affected by the Dallas and Fort Worth SMSA's. The region received 7 percent of its earnings from this sector, in comparison to a U.S. figure of 5.2 percent. The 4,195 financial, insurance, and real estate establishments in the Dallas and Fort Worth SMSA's generated 94.1 percent of all the income in this sector for the region.

Contract construction earnings

5.6 percent of regional earnings  
6.1 percent of U.S. earnings

Contract construction was the seventh-largest contributor to earnings in the twenty-six county study region. This sector contributed 5.6 percent of the total earnings, one-half of one percentage point below the national figure.

Mining earnings

1.6 percent of regional earnings  
1.3 percent of U.S. earnings

Farm earnings

1.3 percent of regional earnings  
3.3 percent of U.S. earnings

### Other nonfarm earnings

0.2 percent of regional earnings  
no figure for United States

Three other industrial sectors contributed to regional earnings. Mining generated 1.6 percent of the region's earnings, slightly above the U.S. figure for 1970. Farm earnings amounted to 1.3 percent of the regional total and was less than half of the U.S. figure. Miscellaneous earnings amounted to 0.2 percent of the total.

### Dallas and Tarrant County Earnings

Total earnings for Dallas and Tarrant counties jumped 19 percent from 1968 to 1970. The 1970 earnings figure was 7.5 billion dollars. This rate of increase is 13.1 percentage points greater than the percentage increase for the United States for the same period.

### Manufacturing earnings

25.4 percent-Dallas/30.5 percent Tarrant  
27.7 percent of U.S. earnings

The largest portion of earnings came from the manufacturing sector for both Dallas and Tarrant counties. Dallas County received 25.4 percent of its earnings from the manufacturing sector, Tarrant, 30.5 percent. These percentages did not differ substantially from the national figure of 27.7 percent.

### Wholesale and retail earnings

23.6 percent-Dallas/14.4 percent Tarrant  
16.5 percent of U.S. earnings

The wholesale and retail trade sector was the second-largest source of earnings for Dallas and Tarrant counties. Dallas County received 23.6 percent of its earnings from this sector in 1970, and Tarrant, 14.4 percent. Tarrant County was 2.5 percentage points below and Dallas County was 7.1 percentage

points above the U.S. figure. The fact that Dallas County received a larger proportion of its earnings from this sector than Tarrant County and the rest of the United States might be attributed to the fact it performs a large distribution function.

For example, 64.9 percent of the population for these two counties reside in Dallas County and 69.7 percent of the 13,047 wholesale and retail establishments in these two counties are located in Dallas County. Relative to other U.S. counties, Dallas County is densely populated and enjoys a growth rate higher than most.

#### Service industries

15.9 percent-Dallas/11.7 percent-Tarrant  
15.2 percent of U.S. earnings

The service industry was the third-largest source of earnings in Dallas County and the fourth-largest in Tarrant County. Dallas County received 15.9 percent of its earnings from this sector, Tarrant County, 11.7 percent. The Tarrant County percentage was 3.5 percentage points below the national figure.

#### Transportation, communication, and public utilities earnings

9.9 percent-Dallas/4.7 percent-Tarrant  
7.1 percent of U.S. earnings

The transportation, communication, and public utilities sector ranked fourth in contribution to earnings in Dallas County and fifth in Tarrant County. The Tarrant County figure was slightly over half of the U.S. figure of 4.7 percent. This sector, and in particular transportation, will make a larger contribution to earnings in Tarrant County in the future once all the benefits of the regional airport are realized.

Finance, insurance, and real estate earnings

8.9 percent-Dallas/4.0 percent-Tarrant  
5.2 percent of U.S. earnings

The finance, insurance, and real estate industry was the fifth-largest generator of income in Dallas County and the sixth-largest in Tarrant County. Dallas County received 8.9 percent of its earnings from this sector in 1970, and Tarrant County, 4 percent. Dallas County's earnings from this sector are slightly greater than those of Tarrant County and the rest of the United States because this county is the financial center of a growing region. For example, 76.5 percent of the income generated by this sector in the twenty-four county region came from establishments in Dallas County.

Government earnings

8.0 percent-Dallas/14.4 percent-Tarrant  
17.7 percent of U.S. earnings

Earnings from government agencies or groups accounted for 8 percent of Dallas County's earning and 14.4 percent of Tarrant County's; both figures are slightly below the U.S. figure of 17.7 percent. State and local government contributed 58.8 percent of the earnings from this sector in Dallas County and 47.6 percent in Tarrant County.

Contract construction earnings

6.4 percent-Dallas/3.9 percent-Tarrant  
6.1 percent of U.S. earnings

Contract construction industries were the seventh-largest generators of income in both Dallas and Tarrant counties. This industry accounted for 6.4 percent of the earnings for Dallas County and 3.9 percent of Tarrant County's total.

Mining earnings

1.8 percent-Dallas/0.97 percent-Tarrant  
1.3 percent of U.S. earnings

Farm earnings

0.05 percent-Dallas/0.23 percent-Tarrant  
3.3 percent of U.S. earnings

Other nonfarm earnings

0.13 percent-Dallas/0.1 percent-Tarrant  
no comparable national figure

Three broad industrial sectors contributed to the earnings for Dallas and Tarrant counties. Mining contributed 1.9 percent of Dallas County's earnings in 1970 and 0.97 percent of Tarrant County's. This mining took the form of quarrying and processing of sand, gravel, cement, and stone. Farming in Dallas and Tarrant counties contributed a negligible proportion of their earnings; both figures were below the U.S. figure of 3.3 percent. Other miscellaneous industries contributed 0.13 percent of Dallas County's earnings and 0.1 percent of Tarrant County's.

## CHAPTER II

### MAJOR USERS OF TRANSPORTATION

#### Introduction

In this survey of the nature and scope of operation of major users of transportation in the study area, several secondary data sources were used. The primary sources are Annual Survey of Manufactures (1971, 1967), Census of Transportation (1967), and County Business Patterns (1971). From these and several less publicized sources, researchers developed up-to-date, accurate figures and estimates.

The Dallas-Fort Worth SMSA had a total of 3,184 manufacturing units reporting in the 1973 Directory of Texas Manufacturers. These manufacturers are broken down in this study into industry groups. A general description is given of the size, resource requirement, and market area of those industries for which reasonably accurate data are available or for which reliable estimates can be made.<sup>3</sup>

#### Food and Kindred Products Industry

In 1971, 232 units were reporting in the Annual Survey of Manufactures in the food and kindred products industry. The largest groups surveyed in this category were meat products (24 units), bakery products (26 units), and

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<sup>3</sup>In this section the volume and operating data presented on manufacturers came from the 1967 Census of Transportation, unless otherwise specified; general information on manufacturers was obtained from the Annual Survey of Manufactures; data for nonmanufacturers was collected from County Business Patterns; rough estimates of 1971 volume for certain industries were calculated by use of statistical deflation.

miscellaneous foods and kindred products (62 units). Approximately 38 percent of the tons distributed in 1967 originated in this industry. Fifty-nine percent of the manufacturers fell into the four smallest employment-size classes. (For a better discussion of the research procedure and terms used in the 1967 transportation census, see the original Census of Transportation for 1967.)

The food and kindred products industry might be labeled a regional marketer, with 81.4 percent of the goods distributed in 1971 reaching the West South Central regional market. Although this industry was basically a regional supplier, it distributed goods to all regions of the United States.

#### Apparel and Fabricated Textile Products Industry

Two hundred and twenty-seven manufacturing units were in the apparel and other fabricated finished textile products industry in 1971. Sixty-one percent of the manufacturers fell into the employment-size class of fifty or fewer employees. This group generated .4 percent of the manufactured tonnage shipped. The West South Central regional market received 41.3 percent of the tonnage, and the remaining 58.7 percent was distributed nationally, with the East North Central and South Atlantic markets receiving the biggest shares--14.7 percent and 12 percent, respectively.

#### Furniture and Fixtures Industry

The furniture and fixtures industry had 139 manufacturers represented in the 1971 survey. Approximately 87 percent of the manufacturers were in the four smallest employment-size classes, and the overall industry generated .5 percent of the tonnage shipped. Unlike many of the industries in the study area, it did not totally depend on the regional market; 48 percent of its estimated tonnage in 1971 reached the West South Central market, but the

remaining 52 percent was nationally distributed with the Mountain (18.5 percent) and West North Central (10.2 percent) markets receiving the largest proportions.

#### Paper and Allied Products Industry

The 93 manufacturers in the paper and allied products industry reporting in the 1971 survey produced 3 percent of the tonnage shipped that year. The four smallest employment-size classes included 56 percent of the total number of manufacturers. Of the goods shipped into the West South Central market (87.6 percent of the total manufactures), 79.6 percent was shipped within 300 miles of the Dallas-Fort Worth economic area.

#### Chemical and Allied Products Industry

In the chemical and allied products industry, the 203 units surveyed in 1971 generated 21 percent of the tons shipped. Eighty-four percent of the manufacturers fell in the employment-size classes of fifty or less employees. The largest groups in this industry were soap, cleaning and toilet goods (53 units), industrial chemicals (30 units) and miscellaneous (54 units). Seventy-six percent of this industry's tonnage entered the West South Central regional market.

#### Rubber and Miscellaneous Plastic Products Industry

The largest group in the rubber and miscellaneous plastic products industry was composed of the 76 miscellaneous plastic products manufacturers. Those 76 manufactureres and the 16 others reporting in 1971 generated .7 percent of the tonnage for that year.

The market for this industry's products was evenly distributed throughout the regions of the United States, with 13 percent of the tonnage reaching the



Middle Atlantic states, 20 percent, the East North Central, 11.1 percent, the West North Central, 13.3 percent, the South Atlantic, 16.3 percent, the West South Central, and 12.7 percent, the Pacific region. Seventy-nine percent of the units in this industry were in the four smallest employment-size classes.

#### Stone, Clay, Glass, and Concrete Products Industry

The stone, clay, glass, and concrete products industry was a large tonnage producer, according to data presented in the 1967 Census of Transportation. This industry, responsible for 23 percent of the tonnage handled, was made up of 120 manufacturers, 79 percent of which had fewer than 50 employees. The single largest group in this industry was the concrete, gypsum, and plastic products manufacturers.

This industry was almost totally a regional marketer, with 96.6 percent of all its tonnage absorbed in the West South Central regional market. Approximately 54 percent of all tonnage shipped was destined for markets 300 miles or less from point of production.

#### Primary Metal Industry

The primary metal industry in 1971 was dominated by the nonferrous foundries, which made up 41 percent of the total units reporting in the survey of manufacturers for that year. The vast majority (77 percent) of the manufacturers in this industry employed less than 50 people. The 71 manufactures in the industry produced 5 percent of the tonnage moved.

Although this industry mainly served a regional market (52.9 percent of the volume was absorbed by the West South Central regional market), it did serve all regions in the United States, with the East North Central and East South Central regions receiving a combined total of 22.9 percent of the tonnage moved. This industry shipped 56.4 percent of its tonnage beyond 300 miles.

### Fabricated Metal Products Industry

The fabricated metal products industry in 1971 was characterized by a concentration of manufacturers in the fabricated structural metal section. Of the 341 reporting units, 48 percent fell into that category. The total industry was responsible for 7 percent of the tons generated in the study area.

Approximately 82 percent of the manufacturers employed fewer than fifty people. The industry was generally a regional marketer, with 66.3 percent of its volume directed at the West South Central market.

### Machinery (except electrical) Industry

The machinery, (except electrical) industry had the largest number of units, with 468 units reporting. Eighty-four percent of these manufacturers belonged in the four smallest employment-size classes. The industry contributed 2 percent of the tonnage shipped, according to the 1967 transportation census.

The industry penetrated the West South Central regional market with 40.9 percent of its total tonnage, and 14.2 percent was destined for the East North Central market.

### Transportation Equipment Industry

The transportation equipment industry was dominated by the motor vehicle and equipment, (21 units), and the aircraft and parts, (14 units) manufacturers in 1971. A total of 47 manufacturers in 1971 produced 3 percent of the tons shipped.

Although only 36 percent of the manufacturers had more than 50 employees, of that group 24 percent belonged in the two largest employment-size classes.

Generally the industry served a regional market, with 76.2 percent of its tonnage distributed in the West South Central market but certain divisions were

anomalies. For example, 79.6 percent of all aircraft parts were shipped outside this region, with the Pacific region--the main market--receiving 32.4 percent of the volume.

#### Electrical Equipment and Supply Industry

The 162 manufacturers reporting for the electrical equipment and supply industry in 1971 might be classified as generally small operations, (72 percent employed fewer than 50 people). This industry generated .06 percent of the total volume moved, and 23.6 percent of its output was destined to the West South Central regional market. The industry also served a national market, with 18.4 percent and 17.6 percent going to the Pacific and West North Central regions, respectively.

#### Wholesale and Retail Trade Establishments

The manufacturers discussed in detail in this study are by no means the only significant transportation users in the study area. A total of 13,047 establishments were located in the wholesale and retail trade area in 1971. Although there are no available data on the destination and origin of goods for this group, with the exception of the data collected during this survey, this study attempts to describe the various groups in this area and their activities.

In the Dallas-Fort Worth economic area, there were a total of 4,455 establishments reporting in the wholesaling area, according to data presented in the 1971 County Business Patterns. These wholesalers fell into nine categories: (1) motor vehicle and automotive parts and supplies (443 units), (2) drugs (223 units), (3) dry goods and apparel (202 units), (4) groceries and related products (347 units), (5) farm-products raw material (85 units), (6) electrical goods (403 units), (7) machinery, equipment, and supplies (999 units), (8) hardware, and plumbing and heating equipment and supplies

(290 units), and (9) miscellaneous wholesalers (1,377 units).

These wholesalers performed marketing functions ranging from a designated agent to a break-bulk operator. The wholesalers were generally small operations, with 92.8 percent employing fewer than 50 persons.

A total of 8,592 retailing establishments reported in the 1971 County Business Patterns. Some of the largest groups in this area were general merchandise (417 units), automotive dealers and service stations (1,954), apparel and accessory stores (744 units), eating and drinking establishments (1,827 units), and miscellaneous retail stores (1,809 units). The retailing establishments provide varying services to their customers and are scattered throughout the study area.

### CHAPTER III

#### NATURE AND SCOPE OF OPERATION OF SELECTED INDUSTRIES

During the survey recently completed, 41 major users of transportation in the Dallas-Fort Worth economic area were contacted. Researchers interviewed 18 manufacturers from various industries and 23 distributors of various types. Although the sample was small (approximately 10.2 percent of the 176 largest manufacturers were surveyed), the information gained from this survey, in conjunction with other published data, contains enlightening facts.

In the following pages, the various manufacturers and distributors interviewed are presented in the aggregate and broken down into various industry groups and distributor types; this is done not only for strictly statistical or analytical reasons, but also to insure the integrity of the sources.

The location of a facility is a main determinant of the access that facility has to transportation services and the quality and efficiency of those services. The people responsible for land use practices and policies in the study area are aware of this situation. Today a total of 112 planned industrial parks or districts are found in the Dallas area alone. Eighty-five percent of all industrial facilities are located in such parks.<sup>4</sup>

These districts are strategically located to main thoroughfares and rail facilities and are accessible to the 39 motor carriers in the area. Maps showing the 92 industrial parks in the Dallas area and the land use pattern for this area are presented in this report in order to facilitate discussion of the

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<sup>4</sup>Dallas Chamber of Commerce, "Guide to the Dallas Metro Area Planned Industrial Districts," 1972/73, p.6.

spatial diffusion of major users of transportation in the study area.

The 41 manufacturers and distributors surveyed generally were located along or close to the major transportation arteries in the area. The land use map (Figure 3) adopted from one developed by the Dallas-Fort Worth Regional Transportation study depicts this clustering of various facilities around major traffic arteries. The diffusion pattern is similar to that observed for industrial parks.

In this report a system approach is taken in analyzing transportation in the study area. In this perspective, the individual industry or firm is not very significant in the assessment of the transportation problem facing an area; it is only when the total human, economic, and technological resources of all participants in the system are weighed that a handle is put on the problem.

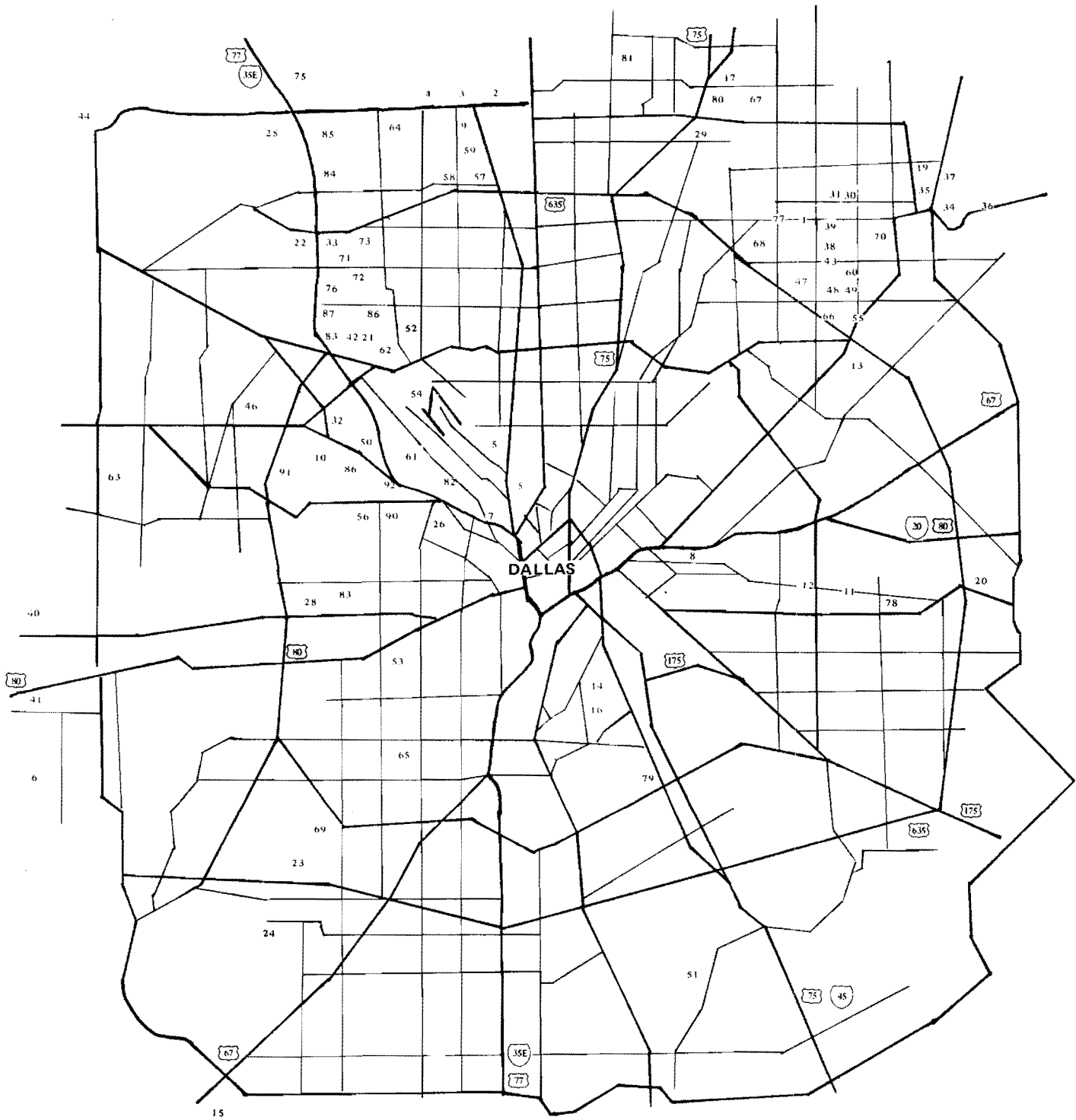
In the following subsections, research findings from this project are buttressed by 1967 Census of Transportation data to provide an overview of the transportation practices of the industries considered.

#### Manufacturers Surveyed

The food and kindred products industry in 1967 was characterized by a preponderance of shipping by truck. There was no substantial difference between the service provided by private carriers and that provided by motor carriers. Private and motor carriers were responsible for 31 percent and 40.6 percent of the goods handled, respectively. Rail moved 27.9 percent and air a mere .1 percent of the tonnage shipped. Some sections of the industry relied more heavily on private carriers than others; for example, 64.8 percent of the meat products were handled by private carriers in 1967.

Figure 2

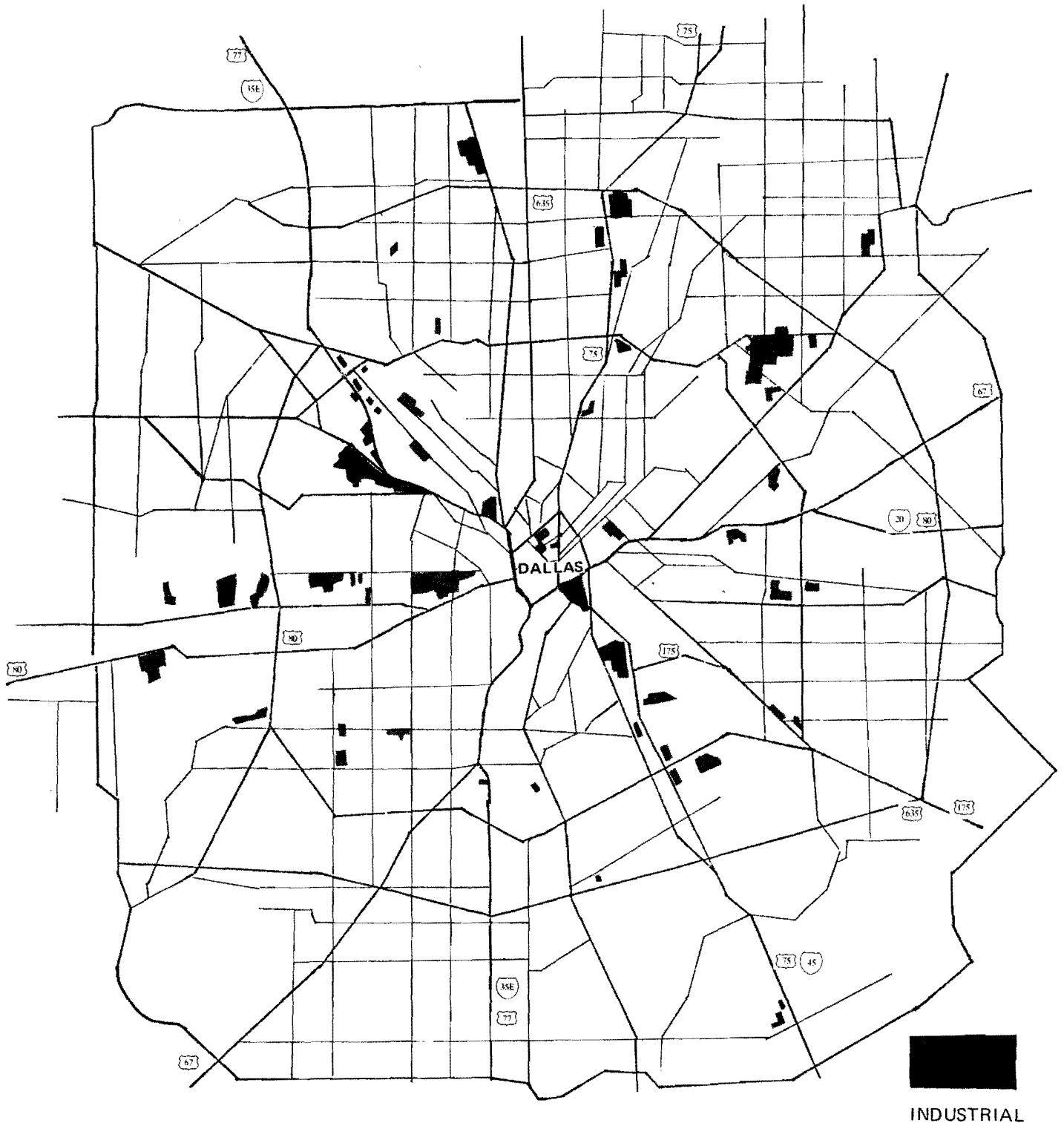
INDUSTRIAL PARK LOCATIONS—DALLAS



Note: The numbers correspond to industrial parks; the locations are approximate.

Figure 3

LAND USE PATTERN IN DALLAS





### Food and kindred products industry

During the recent survey nine manufacturers in the food and kindred products industry were surveyed. The vast majority (eight of the nine manufacturers surveyed) utilized private carriers to varying degrees. On an average, 85.4 percent of all outbound tonnage was shipped by private carrier, 12.7 percent by common motor carrier, and 1.9 percent by rail. For inbound shipments, the transportation burden was shifted to common carrier and rail, with handling 48.2 percent and 51.4 percent, respectively.

The degree to which the manufacturer makes use of more than one mode of transportation is important. Of the nine manufacturers queried, seven used more than one mode. The rail and truck combination was utilized by four. The rail/truck/pipeline arrangement was used by one manufacturer; the truck/pipeline arrangement was used by one. Only two manufacturers utilized a single mode exclusively.

The eight manufacturers operating their own equipment had a combined fleet of 1,110 units, which were put to various uses. The vast majority, 52.2 percent, or 579 units, were utilized in local pickup and delivery. There was some interplant and plant to warehouse use made of many of the units.

These 579 units and a certain percentage of the over-the-road units were utilized in serving approximately 549 routes.<sup>5</sup> Generally respondents were reluctant to give detailed information on customers served, but the fact that one manufacturer served approximately 205 customers on a regular basis suggests that service is extensive.

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<sup>5</sup>The figure for routes served is not completely accurate because several respondents did not consider routes in discussing the extent of their service but chose to talk in terms of customers, i.e., customer and route were synonymous.

The average warehouse size for manufacturers supplying this information was 96,000 square feet. Seventy-five percent of the respondents had 60,000 square feet or more warehousing space. The warehouses ranged in size from 40,000 square feet to 220,000 square feet.

For technical, legal, and economic reasons the loading and unloading facilities varied among the manufacturers in the food and kindred products industry. Many manufacturers utilized specialized doors or bays. Many of these specialized facilities were required to unload certain bulk dry and liquid materials for subsequent use in the production process. The equipment used in transporting many of these items also exerted some influence on the facilities used in loading and unloading; for example, several soft drink bottlers required special equipment to remove the sugar that was brought in by rail tank cars. Generally these specialized facilities made transporting of goods economical and safe.

#### Fabricated metal products

The fabricated metal products industry was predominately a utilizer of private carriers, according to the 1967 Census of Transportation. The private carrier was responsible for 44.5 percent of all tons shipped by manufacturers in this industry for the entire state. Motor carriers, rail, air freight, and water were responsible for 29.8 percent, 17 percent, .1 percent, and 7.9 percent, respectively. Although all these shipping practices are not directly applicable to the economic study area (for example water transportation is not available for shippers in the Dallas-Fort Worth study area), these statewide figures do provide some overview of the transportation practices of this industry.

Two rather dissimilar manufacturers in the fabricated metal products industry were surveyed by researchers. One was basically a structural steel

fabricator, the other, a small-components fabricator. Although the sample of this industry is relatively small, those manufacturers surveyed provided a valuable view of the transportation requirements of certain sections of the industry.

The nature and scope of operation of the manufacturer dictates the type of transportation used. The structural steel fabricator, using large and bulky steel beams and forms in his manufacturing process, used rail for 95 percent of all inbound shipping. The small-product fabricator was unable to provide a percentage of inbound material carried by various modes but did indicate that motor carriers were responsible for most of the inbound shipping. For outbound shipments, the structural steel fabricator used 50 percent rail and 50 percent truck (approximately 45 percent motor carrier, 5 percent private carrier); the small component fabricator used motor carrier for 90 percent of the outbound tons shipped and package express for 8 percent.

A primary measure of the magnitude of the transportation needs of a manufacturer is the number of units dispatched and received at a facility. The manufacturers surveyed were primarily utilizers of motor carriers. The number of units received by the two manufacturers averaged about eleven per day and an average of fifteen were dispatched per day.

The two manufacturers surveyed had a total of 40 acres of land for their plant and warehousing facilities. One manufacturer had a storage capacity of approximately 1.5 million square feet. A portion of this space was enclosed but the vast majority was open. The inventory turnover, which ranged from three months to well over a year, in combination with the size of the items stored, determined the type of storage facility used. The second manufacturer surveyed was unable to make an estimate of warehousing space but did state that fifteen bays were used in shipping and receiving.

### Electrical and electronic equipment and supply industry

The 1967 Census of Transportation statistics indicated that the electrical and electronic equipment and supply industry used motor carriers for 72.7 percent of the tons shipped. Rail, private carrier, and air were responsible for 2.1 percent, .9 percent, and 21.6 percent of the tons shipped, respectively. This industry was characterized by long-distance shipping, with 86.8 percent of the tonnage shipped in excess of 200 miles and 40.9 percent over 1,000 miles.

The manufacturers from this industry tended to use motor carriers for most shipping. Motor carriers were responsible for 98.7 percent of all outbound tons shipped and 98.5 percent of all inbound tons. Bus, air freight, and parcel post were responsible for .08 percent, .4 percent, and .7 percent of outbound tonnage, respectively. Air freight and bus were responsible for 1.1 percent and .3 percent of all tons shipped inbound, respectively. Although this manufacturing firm was predominately a user of for-hire carriers, it did operate two units for transporting finished goods from the plant to the warehouse.

The manufacturer surveyed maintained 80,000 square feet of warehousing space. Eleven conventional bays were used for receiving and shipping. The manufacturer indicated that the average warehouse space utilization was 75 percent and the average inventory turnover was every 180 days.

### Machinery industry

Statewide statistics for the machinery industry showed that 67.8 percent of all tons was shipped by motor carrier. Private carriers transported 21.4 percent, rail 9.5 percent, air freight .4 percent, and water .1 percent. In certain sectors of this industry motor carriers predominate. For example, the

oil field machinery industry, which required larger specialized equipment, used motor specialized haulers for 92.5 percent of its shipped tonnage.

Two manufacturers from the machinery industry were interviewed. The statistics compiled on these manufacturers indicate that they followed the shipping pattern of the industry, with approximately 98.6 percent of all tons shipped carried by motor carriers. One manufacturer had 98.5 percent of inbound tonnage and 98.7 percent of outbound tonnage carried by motor carriers. One respondent was unable to give a percentage of inbound tons shipped by various modes, but did indicate that motor carriers and package express were responsible for 90 percent and 8 percent of outbound tonnage shipped, respectively. For one manufacturer, the following carriers transported inbound and outbound freight: air freight, 1.1 percent in/.4 percent out; bus, .3 percent in/.08 percent out; and parcel post, .7 percent outbound.

Although the respondents in the survey were basically users of motor carriers and did not maintain thorough records on the carriers serving their facilities, they were able to estimate the number leaving their facility each day. The two manufacturers had a total of 30 line movements per day leaving their facilities. One manufacturer used two company-owned units for intraplant transportation.

The manufacturers surveyed had facilities located on a total of 11.8 acres. Not all manufacturers were able to provide figures on warehouse facilities, but one maintained 80,000 square feet of warehousing space and used 11 conventional doors for shipping and receiving.

#### Apparel industry

Statewide statistics indicate that the apparel industry used motor carriers for 66.2 percent of the tons shipped. Private carriers were responsible for shipping 23.8 percent and rail for .2 percent.

One manufacturer in the apparel industry was surveyed. This manufacturer used package express for 90 percent of outbound shipments. Motor carriers were responsible for 10 percent of the tonnage shipped.

This manufacturer maintained three vans for local deliveries. There were few if any variations in the delivery pattern.

The manufacturer surveyed had 8,400 square feet of warehousing space, with three conventional receiving and shipping spots or bays. The average warehouse space utilization was 88 percent and the inventory turnover was approximately 38 days.

#### Paper and allied products industry

The paper and allied products industry in the economic study area was basically a private carrier. Private carriers were responsible for 62.3 percent of all tons shipped, and rail and motor carriers were responsible for 6.3 percent and 22.3 percent, respectively.

One representative of the paper and allied products industry was surveyed. The manufacturer operated a private fleet that transported 40 percent of all goods shipped. The motor carriers were responsible for 60 percent of all tonnage handled.

The company maintained a fleet of 50 units. Eighteen were used for delivery service in the economic area. Although no exact figure was given, the manufacturer indicated that the bulk of its raw material came in by rail.

#### Stone, clay, glass, and concrete product industry

The stone, clay, glass, and concrete products industry, responsible

for approximately 21 percent of the total volume shipped from the economic study area, used motor carriers for 61.4 percent of its tonnage shipped. Rail and private carriers shared almost equally, with 18.7 percent and 19.9 percent, respectively. This industry reported that 58.3 percent of its total volume was absorbed by consumers less than 100 miles from the point of production.

Researchers were able to interview one manufacturer from this industry. The respondent maintained an aggregate plant that was responsible for supplying its basic raw material. The raw material was shipped into local ready-mix plants by rail (49 percent) and truck (51 percent).

The finished products were distributed by 75- to 100-batch units in the Dallas area. The manufacturer maintained several ready-mix plants in the area. The batch units were radio-equipped and operated on a order basis, i.e., routes were irregular. The trucks used in the transporting of raw material from the aggregate plant to the ready-mix facilities were owner-operator units.

#### Chemical and allied products industry

The chemical and allied products industry was a major user of motor carriers. Motor carriers were responsible for 63.3 percent of the tons shipped, rail for 33.1 percent, and private carrier for 13 percent. This industry generated 20.5 percent of the volume moved, according to the Census of Transportation for 1967.

Researchers surveyed three manufacturers from the chemical and allied products industry. These manufacturers exhibited interesting variations in their transportation policies and practices.

One respondent found it economically feasible to operate a private fleet only within a 50-mile radius; any shipments destined for customers outside this area were given to motor carriers. One manufacturer found it profitable to lease tank cars and eliminate some of the demurrage charges.

For the three manufacturers, 59.1 percent of the outbound tonnage was shipped by motor carrier, 9 percent by rail, and 13 percent by private carrier. The common carrier service for one manufacturer was split between motor and TOFC (truck on flat car). For tonnage shipped out by common carrier, 45 percent was transported by motor carrier and 40 percent by TOFC, commonly called piggyback.

Only one of the manufacturers surveyed maintained a private fleet. This manufacturer operated fourteen units; ten units were used for local deliveries. The company had six regular routes on which its units were dispatched daily.

The average warehouse size for manufacturers surveyed was 333,333 square feet. Warehouse facilities ranged in size from 75,000 to 600,000 square feet.

These three manufacturers maintained a total of 101 receiving and shipping facilities. Many of the facilities were designed to meet the unloading requirements of the equipment used in transporting raw material; for example, certain dry chemicals were transported in tank cars and required special pneumatic pipelines for unloading.

#### Transportation equipment industry

According to 1967 Census of Transportation figures for the state of Texas, 46.7 percent of the tonnage generated by the transportation equipment industry was carried by motor carrier. Rail handled 38.8 percent, private carrier 13.7



percent, and air 0.7 percent of the tonnage.

During the recent survey one manufacturer from this industry was contacted. The Arlington, Texas, division of General Motors utilized rail and for-hire carriers extensively in its transportation system; although no data exist on the percentage of inbound material carried by various modes, it can be assumed that rail is the chief transporter in this area, given the source of the material and the larger quantities of it used. For outbound shipping, rail and motor carrier probably play equally important roles, in light of the marketing area for this manufacturer.

#### Wholesale and Retail Trade Establishments Surveyed

The Dallas-Fort Worth economic area is fast becoming a leader in many areas, particularly in the area of distribution. The most recent figures indicate that 476 manufacturers have distribution centers in the Dallas area alone. The 8,592 wholesale and retail establishments in the study area have caused the development of a complex network of distribution channels. Probably the most important function performed by these distribution channels, along with many other marketing functions, is that of physical movement of items.

Researchers interviewed 23 distributors of various types and sizes. Some acted as regional distributors, while others were strictly local. In the following pages the distributors are broken down into categories and their function and transportation requirement are discussed.

#### Grocery-general line

Among the largest movers of goods in the study area are the grocery-general line wholesale distributors. Researchers interviewed ten distributors in this category.

The grocery distributors surveyed tended to use trucks for the majority of their shipping. Generally there was a tendency for those operating sizable

private fleets to rely on motor carriers for much of the inbound shipping.

For those distributors capable of providing accurate figures, trucks carried 55.4 percent of all inbound tonnage. Although no breakdown was given for the amount carried by private and motor carrier by all respondents, it was generally stated that for-hire carriers were responsible for most of the outbound shipping. Rail service accounted for 45 percent of all incoming tons. Shipments directly from shippers accounted for approximately .06 percent of all inbound tonnage.

Many of the grocery distributors acted as private carriers, to varying degrees. Approximately 70 percent of the distributors were private carriers. These fleets ranged in size from two units to 526 units. Many of the units were utilized for strictly local service, others for statewide or regional distribution (approximately 60 percent were used for regional service, 10 percent locally). Two respondents depended entirely on motor carrier and rail for their incoming and outgoing shipments. One respondent owned several rail cars in order to insure the availability of equipment.

The trade-off between various modes for certain inbound shipments tended to be a function of the nature of the commodity and its origin. Several distributors indicated that certain grocery items were shipped by a particular mode (for example, one distributor stated that 65 percent of its cereals came in by rail because they were produced in areas so far away and consumed in such large quantities that any other mode would not be economical) because of the distance between the producing unit and the consumer. Many distributors utilized trucks for many of the regionally produced meat and produce products.

The average number of bays for the distributors surveyed was 77. The median number of bays was 68. The number of bays ranged from 17 to 140.

The average warehouse for the distributors surveyed was 415,000 square feet. The storage space ranged from 95,000 square feet to 1.5 million square feet. The average space utilization was 97.2 percent. Many respondents indicated that in determining usable warehouse or storage space it was necessary for technical and safety reasons to maintain a minimum clearance of three feet between the lowest part of the ceiling and the items stacked.

#### General merchandise wholesalers

Researchers were able to interview two major general merchandise distributors in the study area. Because of the size and scope of operation of these businesses, a good picture is provided of the marketing and distribution functions performed by distributors of this type.

The distributors surveyed to varying degrees provided inventory control as well as distribution services to outlets served. One distributor surveyed was described as a metroplex (this is a term used to describe the Dallas-Fort Worth area) distribution headquarters. In this position this distributor maintained a certain degree of control over all the stores it served in the study area.

A metroplex pooling or warehousing function was performed by the same distributor. Many of the items destined for the retail outlets were distributed from this facility, i.e., no outlet received any of these items directly from the shipper. This distributor also operated a private freight-forwarding facility.

As a private freight forwarder this distributor was able to realize tremendous savings in the cost of warehousing and expedite the movement of the goods. The freight-forwarding facility was utilized for certain items. The orders for a particular outlet were aggregated at this facility and quickly picked up by that outlet; savings were realized since storage time was reduced

and outlets could pick up their items as quickly as possible. Common motor carriers, rail, and TOFC services were used in this operation.

The second general merchandise distributor performed many of the functions of the first but did not have such an elaborate inventory and warehousing operation. Essentially, retail outlets in the study area and throughout the state were served by this distributor. Periodic sales and other marketing functions were closely coordinated with this distributor in order to assure that adequate items were in stock.

The general merchandise distributors surveyed controlled their transportation operations either by being private carriers or by utilizing contract carriers. The combined fleet for these distributors was 738 units.

One respondent leased 150 units for over-the-road deliveries and utilized a contract carrier for its local deliveries. This distributor also owned and operated 51 customer service units used strictly in the study area. The second distributor, a private carrier, operated a total of 537 units. A total of 26 units were used for interwarehouse transfers and 60 units for local retail and customer deliveries. The remaining units were for over-the-road deliveries.

Along with the transportation equipment operated by the distributors themselves, use was made of rail and common carriers. One respondent estimated that piggyback service accounted for 55 percent of all inbound shipments, while motor common carrier carried 40 percent and private carrier 5 percent. This respondent was unable to provide an exact percentage of the outbound tonnage carried by various modes but did state that the contract carrier was responsible for most. This distributor operated as a private freight forwarder for his goods exclusively and TOFC, rail, and truck were the modes used for both inbound and outbound shipping in this operation. The other distributor used truck, TOFC, and rail to varying degrees. For example, all softline items

(clothing and other wearing apparel and items made of fabric, with the exception of furniture) were shipped in exclusively by truck; rail was used for 90 percent of all appliances shipped to the facility. This distributor indicated that its private fleet was responsible for most of the outbound shipping but the common motor carrier handled a substantial amount (2,855 customers throughout the West South Central region were served by motor common carrier).

#### Beer and ale wholesale distributors

Two beer and ale distributors were surveyed by researchers. These wholesalers were local distributors only and both were private carriers. The combined fleet for these distributors was 70 units.

The distributors surveyed indicated that rail was the chief means by which most of their inbound cargo was transported. One distributor estimated that 99.9 percent of all inbound tonnage was carried by rail. The second distributor was not able to estimate what percentage of inbound tonnage came in by rail but did indicate that the amount was significant. For outbound shipping one distributor indicated that most of the LTL (less than truckload) shipments were given to common carriers and all volume or full loads were hauled in company equipment. These distributors served a total of 50 routes in their marketing area.

The distributors surveyed had a combined total of 80,000 square feet of warehousing space. One distributor had unloading facilities that could accommodate ten rail cars and one truck simultaneously. The other distributor maintained four conventional bays for unloading.

This particular area of wholesaling has been greatly affected by changes in consumers' tastes and preferences and in technology. Both distributors said that glass beer bottles make up a smaller proportion of their total

volume because of consumers' preference for the convenient aluminum can. Another factor affecting this type of business is the complete palletization of all cargo. With the exception of final distribution of the retail outlets, all handling is done by machinery.

#### Photographic and equipment supply dealers

Researchers surveyed one photographic and equipment supply distributor in the economic study area. The distributor was the regional distributor for a major manufacturer.

Inbound shipments were almost exclusively transported by rail. Common carriers were responsible for periodic shipments from a closer manufacturing plant. The company operated no private fleet and utilized for-hire carriers for all outbound shipping.

Warehousing space totaled 300,000 square feet. Twelve bays were used for loading and unloading. Warehouse space utilization was 60 percent, and inventories turned four times a year.

#### Lumber and building material dealer and distributor

The representative of the lumber and building material industry operated through a world-wide distribution channel; all of the continental United States and approximately 27 foreign countries were served.

The service provided by this dealer was greatly affected by operating rights and certain economic factors. Because of intransit storage privileges this dealer was capable of providing a wide range of transportation arrangements. For example, it was economically feasible to provide many customers with LCL shipments even though higher freight rates were imputed and the intransit time was generally longer than that for full loads; the feasibility derives from the fact that the savings associated with intransit storage privileges generally offset the higher charges levied on LCL shipments.

This dealer used rail for 70 percent of all inbound shipments destined for the Dallas-Fort Worth economic area and truck for 30 percent. This percentage breakdown does not reflect the total distribution service of the dealer because some of the goods never reach the Dallas facilities but go directly from the mill to the customer.

Trucks were utilized in pickup and delivery for approximately 14 states from Texas to the South Atlantic region. The distributor operated four power units for long hauls and 53 for local deliveries. In this 14-state region, for-hire carriers performed a large proportion of the distribution. Outside this region rail was the predominate transporter for inbound material.

#### Frozen food warehouser and distributor

The frozen food distributor surveyed operated a distribution warehouse. Forty percent of all inbound products were carried by truck and sixty percent by rail.

The distributor utilized private and common carrier for its exempt commodity distribution. The private carrier operation was a leasing arrangement with owner-operators. The distributor was unable to give a percentage breakdown on outbound distribution by various modes, but indicated that trucks were responsible for most.

The warehousing facility for this distributor totaled 140,000 square feet, part of which was refrigerated for meat storage and other commodities requiring refrigeration. Twenty-eight bays for shipping and receiving were available.

From this facility goods were broken down into quantities desired by customers and shipped. There was a practice of pooling shipments in order to realize the savings associated with shipping in large quantities.

Researchers surveyed one distributor primarily engaged in the marketing and distribution of truck parts, tractors and associated implements, and some construction equipment.

This machinery and equipment wholesaler utilized no tractor trailer combinations but operated a number of units for local deliveries. The company was on a program of reducing common carrier service from 36 to 18 lines.

The company received 98 percent of all its inbound items by piggyback. For the customers served by this distributor, there was a practice of pooling orders.

Outbound shipping was shared by the distributor and various common carriers. Although no breakdown was given, it was indicated that common motor carriers, bus express, and local cartage carriers were used for most of the outbound distribution.

The warehousing facility was 196,000 square feet and there were 13 bays for inbound products and five for outbound. In the warehouse the company maintained an overhead tow line that facilitated movement of goods around the facility. A total of 30 packing stations were located throughout the warehouse for preparing items for shipping.

#### Miscellaneous durable goods distributor

Researchers interviewed one wholesaler who dealt with the distribution of items ranging from building hardware to sports equipment. This wholesaler operated 20 trucks and occasionally leased several units during peak periods.

Inbound and outbound shipping was performed by common motor carrier, rail, package express, and air freight. The respondent was unable to provide a percentage of the tonnage carried by each mode but did state that approximately 45 shipments per day were carried by motor carriers and 9,100 by their own units.

#### Petroleum bulk stations

In the economic study area there were approximately 1,336 gasoline service stations. Researchers interviewed two petroleum bulk stations and terminals that were responsible for providing service to many of these retailers.



The two distributors surveyed operated as private carriers, with a combined fleet of 41 units. These units were responsible for most of the outbound distribution. Motor carriers were responsible for a negligible amount of outbound shipping. Pipelines were the chief supplier of gasoline. Rail was responsible for transporting most of the package tonnage.

The two distributors had a total of 26 million gallons of storage capacity. The total space for packaged items amounted to 40,000 square feet. Fifteen bays were associated with the warehousing facilities.

Distribution for both operators was local. One respondent distributed within a 70-mile radius. No distributor served an area greater than 120 miles from its facility.

#### Printing, publishing and allied industry

Researchers interviewed one representative of the newspaper industry in the study area. This newspaper publisher and distributor utilized three different types of distribution arrangements.

The company employed one contract carrier operating 22 trucks and 80 other route contractors. This transportation company was responsible for distribution in Dallas and surrounding areas. The company itself employed 30 independent contractors. The company used a second contract carrier for its longer distribution. Rail and bus were responsible for a sizable portion of the papers distributed.

In the preceding pages a description was given of the facilities and practices of some of the major users of transportation in the study area. It would be erroneous and misleading to generalize from these findings. Many industry groups, distributors, and retailers were not represented in this survey because of time and other constraints. In order to present a more accurate picture of the transportation situation in the study area, some of these major users will be described briefly.

One group that was not surveyed but generates a tremendous demand for transportation includes shopping centers. In the Dallas area alone there are approximately 202 shopping centers, ranging in size from the small general retail facilities with strip-type shopping to large enclosed malls.

The single largest category of shopping centers was composed of major centers with off-street parking. Such centers made up 84 percent of the total. The general retail facility with strip-type shopping accounted for 10 percent of the total. Regional centers with at least two major department stores and floor space in excess of 750,000 square feet accounted for 4 percent of the total. Neighborhood centers with less than 20,000 square feet of floor space constituted 2 percent of the shopping centers.

In summarizing the data presented on the major users of transportation in the Dallas-Fort Worth study area, it is fair to say that a complex and intricate distribution system exists. There were a total of 3,161 privately operated units among the small sample of manufacturers and wholesale and retail establishments used in this study. These operations had a total of 10.1 million square feet of warehousing space. The information used in this report came from .34 percent of the manufacturers and nonmanufacturers in the study area.

Table 4

**VARIATION IN FLEET SIZE AMONG MAJOR TRANSPORTATION GROUPS IN THE STUDY AREA**

Major Users	Truck fleet size*						Total	Number
	1	2-5	6-19	20-49	50-89	GT90		
Manufacturers		23.1	7.7		7.7	61.5	100.0	1,307
Wholesale and retail trade		5.6	16.7	44.4	5.6	27.8	100.0	1,854
Total		12.9	12.9	9.7	6.5	41.9	100.0	3,161

\* The figures correspond to the percentage of respondents falling into the various categories.

Table 5

**VARIATION IN WAREHOUSING OR STORAGE SPACE AMONG MAJOR USERS  
OF TRANSPORTATION IN THE STUDY AREA**

Units	Warehousing space											na	no.*
	-19	20-39	40-59	60-79	80-99	100-119	120-139	140-199	200-399	400-			
Manufacturers	6.3		6.3	6.3	12.5				6.3	12.5	50.0	2.4	
Wholesale and retail trade		13.0		4.3		4.3	4.3	21.7	13.0	21.7	17.7	7.7	
Total	2.6	7.7	2.6	5.1	5.1	2.6	2.6	12.8	18.0	12.8	30.7	10.1	

\* The figures represent the percentage of manufacturers and nonmanufacturers falling into the various categories; na represents the percent of businesses not responding; and no. is the total number of square feet (in millions of square feet).

## CHAPTER IV

### ANALYSIS OF VOLUME AND PATTERNS OF GOODS MOVEMENT

The amount of goods shipped, their origin and destination, and the tendency of demand for transportation to vary over time are the factors explored in this section.

In preceding sections, descriptions were given of the facilities and transportation needs and practices of major users of transportation in the study area. Here a composite view of the transportation activity in the study area will be presented.

In attempting to describe how the various industries, distributors, and other users of transportation fit into the larger picture, this researcher employed several of the procedures used in the 1967 Census of Transportation. The United States was broken down into nine regions for purposes of discussing the origin and destination of goods. This approach was taken because of the availability of general rather than specific origin and destination data.

#### General Volume and Goods Movement Data

The 41 manufacturers and distributors surveyed handled approximately 67.4 million pounds of goods on an average day (31.5 million pounds of incoming items and 35.9 million pounds of outgoing items).<sup>6</sup>

The volume and pattern of goods movement varied among manufacturers and distributors.

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<sup>6</sup>The tonnage figures used in this report are the estimate of respondents and are to be viewed as only rough measures of activity; in some cases only partial tonnage data was provided.

## NINE GEOGRAPHIC REGIONS OF THE UNITED STATES



Generally the manufacturers surveyed experienced no substantial variation in volume on a daily basis even though a number of them pointed to certain days as being heavy for inbound or outbound shipments; but on a yearly basis there was tremendous fluctuation in volume. For example, several soft drink bottlers and syrup concentrate manufacturers experienced their greatest activity during the spring and summer months.

Distributors, unlike manufacturers, experienced greater fluctuation in volume on a daily as well as monthly and yearly basis. Most distributors reported that the first two days of each week were normally a period of peak activity and the middle was generally low. The explanation offered for this situation was the tendency for orders to accumulate over the weekend, with the first two days of the following week being used to ship them out along with normal shipments.

In the analysis of the origin and destination of goods handled by the businesses surveyed, the United States was broken down into nine regions, and this researcher also calculated the percentage of businesses shipping and receiving goods from these regions.

The data presented in Tables 6 and 7 suggest that the manufacturers and distributors surveyed were basically regional suppliers. The West South Central region served as a market for all respondents; and those respondents receiving material from this region ranged from 60 percent of the distributors to 88.9 percent of the manufacturers. The data presented in these tables also provide evidence of a tendency for fewer of the Dallas-Fort Worth based businesses to engage in extensive trade with regions progressively further from the study area.

Table 6

## PERCENTAGE OF BUSINESSES SHIPPING GOODS TO THE GEOGRAPHIC REGIONS OF DESTINATION

Units	Geographic regions								
	1	2	3	4	5	6	7	8	9
Manufacturers	16.7	27.8	22.2	100	22.2	21.0	11.1	16.7	5.6
Wholesale and retail trade	5.0	35.0	20.0	100	10.0	10.0	5.0	10.0	5.0
Total	10.5	31.6	21.1	100	15.8	13.2	7.9	10.5	5.3

Note: The above regions are as follows: 1—Pacific, 2—Mountain, 3—West North Central, 4—West South Central, 5—East North Central, 6—East South Central, 7—Middle Atlantic, 8—South Atlantic, 9—New England. (see Figure 4.)

Table 7

## PERCENTAGE OF BUSINESSES RECEIVING GOODS FROM THE GEOGRAPHIC REGION OF ORIGIN

Units	Geographic regions								
	1	2	3	4	5	6	7	8	9
Manufacturers	11.1	22.2	22.2	88.9	22.2	27.8	5.6	22.2	5.6
Wholesale and retail trade	20.0	15.0	25.0	60.0	40.0	20.0	20.0	30.0	5.0
Total	15.8	18.4	23.7	73.7	31.6	23.7	13.2	26.3	5.3

Note: The regional designations used in Table 6 apply here.

Selected Manufacturers

The first manufacturing group considered in this section is the food and kindred products industry. This industry exhibited some variation in the volume and pattern of goods movement among the manufacturers surveyed. This variation was evident in the origin and destination of goods and the periods of low and high volume.

For example, the full-line meat processor interviewed received most of his raw meat products from Texas sources and distributed most of his finished products in Texas, Louisiana, and parts of Arkansas. This manufacturer received 75 percent of all dressed-out beef from West Texas cattle growers. This manufacturer noted that Mondays tended to be heavy days for outbound shipments because of the backlogging of orders over the weekends. No substantial variation occurred in overall volume on a monthly or yearly basis;

but certain items were consumed more heavily during certain periods of the year.

#### General food and kindred products manufacturers

The two general food and kindred products manufacturers surveyed were greatly affected by the consumer cycle. Both manufacturers experienced no substantial variation in daily inbound and outbound shipping. The most substantial variation occurred on a seasonal or holiday basis. One manufacturer noted that many retail outlets tended to demand more during the cooler periods when consumers used more. Generally the fluctuation these manufacturers experienced could be traced to variation in consumer demands.

In terms of the origin and destination of the goods handled by these manufacturers, raw material and products originated in many parts of the United States and distribution was limited to the four-state West South Central region. Because these manufacturers also acted as wholesale food distributors many of the items not manufactured by them had to be obtained from other sources in order to have a full line. One manufacturer indicated that 20 percent of all inbound items originated in the East North Central region. Another manufacturer shipped 67 percent of all products outside the study area to ten warehouses located in the four-state West South Central region. The second manufacturer shipped to parts of Arkansas and the eastern quadrant of Texas.

#### Soft-drink bottlers and concentrate producers

The four soft drink bottlers and concentrate producers tended to exhibit differences in the volume and pattern of movement, depending on the product and service offered.



For example, the area of distribution for the two syrup and concentrate manufacturers was generally larger than that for the bottlers. One concentrate manufacturer shipped 90-95 percent of all finished products outside the study area to points such as Colorado (10 percent of output), California, Louisiana, and New Mexico. The other concentrate manufacturer shipped 20 percent of its output to points in Texas and the remaining 80 percent to warehouses in Oklahoma, Missouri, Indiana, Minnesota, and Virginia. In contrast, the soft drink bottlers tended to be local distributors. One bottler served the eastern quadrant of Texas. None of the bottlers crossed state lines with their products. Syrup and concentrate manufacturers and bottlers differed also in the broadness of their resource base.

Syrup and concentrate manufacturers received their raw material from a large area. One respondent cited Texas, Louisiana, California, Utah, and Colorado as major sources of raw material. The bottlers to a lesser extent received part of their raw material from states other than Texas. One bottler reported that 80 percent of its glass items originated in Texas, Louisiana, and Tennessee.

The fluctuation in the volume and pattern of goods movement for both bottlers and syrup and concentrate manufacturers tended to be seasonal. The busiest period extended from early spring to late fall. Many of the manufacturers indicated that the first two days of the week were generally busy because of the order buildup over the weekends.

Manufacturers from the food and kindred products industry generated 12.7 million pounds on an average day (4.8 million pounds inbound and 7.9 million outbound). The average inbound shipment was 39,167 pounds, the average outbound shipment was 26,350 pounds.

Metal products fabrication, machinery, and electrical and electronic equipment and supply industry

The manufacturer from the metal products fabrication, machinery, and electrical and electronic equipment and supply industry averaged .8 million pounds per day. The average inbound tonnage was .56 million pounds per day, and the average outbound tonnage was .24 million pounds per day. The average inbound shipment was 31,333 pounds; the average outbound was 22,250 pounds.

The machinery and electrical and electronic equipment and supply manufacturer surveyed distributed 90 percent of all finished products outside of Texas. California received 50 percent of the output; parts of the East North Central, Middle Atlantic and South Atlantic regions also received smaller percentages.

The manufacturer experienced no fluctuation in volume on a daily or monthly basis. During the period of May-July and November-January, the greatest activity occurred.

The manufacturer from this industry distributed and received products from throughout the United States. Twenty percent of his output was destined for the West South Central region, 45 percent for the Pacific and Mountain regions, and 35 percent for the remainder of the United States. Seventy-five percent of all incoming material originated in Michigan, Illinois, Indiana, and Ohio; part of the recreational equipment handled by this manufacturer was assembled in England.

This manufacturer experienced no daily or monthly fluctuation in volume, but certain products experienced seasonal variation. For example, 75 percent of the yearly volume in auto parts was recorded in the period March to July.

The structural steel fabricator interviewed received most of his heavy items from Maryland. Other items came from Colorado and Texas. Houston, Texas, was the origin of most of the items used in the production process.

This manufacturer noted no pattern or trends in his goods movement. Only normal cyclical patterns peculiar to this industry were discernible.

#### Apparel manufacturing industry

The apparel manufacturer handled a total of 38,400 pounds per day, according to data supplied to researchers. This manufacturer's average inbound shipment was 20,000 pounds; the outbound shipment figure was 500 pounds.

This manufacturer shipped 90 percent of his finished products outside the Dallas-Fort Worth economic area. Nearly 100 percent of all inbound shipments originated in New York and North Carolina. Forty-five percent of all outbound shipments were absorbed by the Texas clothing market. Kentucky, Louisiana, and Chicago received 15 percent, 20 percent, and 20 percent, respectively.

Most outbound shipping tended to be heaviest at the end of the week and lightest at the beginning. The end of each month was also a heavy period. This manufacturer reported that the August-October period was the peak season for his clothes.

#### Paper and allied products industry

The paper and allied products manufacturer surveyed handled an average of 554,544 pounds per day. The average outbound shipment was 32,000 pounds.

This manufacturer shipped 95 percent of his finished products to points outside the economic study area. The raw material used in the production process came from Texas and several southern states.

The operating cycle facing this manufacturer was characterized by weekly and seasonal fluctuation. For example, inbound volume tended to peak at the beginning of each week, while outbound volume peaked at the end of each week. This manufacturer indicated that the period extending from May

to September was the period of peak activity; months prior to and after this period were generally moderate.

#### Chemicals and allied products industry

The manufacturers from the chemical and allied products industry handled 1.8 million pounds of goods on an average day. The average outbound shipment was 17,702 pounds.

The manufacturers surveyed were basically regional distributors. The percentages for goods shipped outside the Dallas-Fort Worth area ranged from 33 percent to 99.5 percent.

The goods shipped outside the economic area were destined for the West South Central region and the adjoining states. For example, one manufacturer's output was destined to all states in the West South Central region, Colorado, and the eastern part of New Mexico. Another manufacturer indicated that 75 percent of all outbound shipments were destined for points in Texas; Oklahoma and Louisiana each received 5 percent of the output; Arkansas, Colorado, and Nebraska received 10 percent.

The raw material used by these manufacturers originated from various points in the United States. Areas cited by manufacturers were the West North Central, Mountain, East South Central, and parts of the South Atlantic region.

Manufacturers indicated that certain days and periods of the year were more or less active than others. Several manufacturers noted that the days at the end and beginning of a month were generally heavy volume periods. Several manufacturers cited yearly variation in volume. For example, one manufacturer who handled basically industrial maintenance chemicals found that July and January were periods during which the greatest volume of fertilizers and other lawn-care items were handled.

### Stone, clay, glass and concrete products industry

The single representative surveyed from the stone, clay, glass, and concrete products industry handled 16.8 million pounds per day. The average inbound and outbound shipment was 118,000 pounds.

This manufacturer shipped only 20 percent of his products outside the study area. North Central, Northeast, and East Texas received the bulk of all outbound aggregate.

All raw material used in the manufacturing process came from a local manufacturing unit.

This manufacturer experienced an eight-month period of high volume extending from March to October, but noticed no other variation in activity.

### Selected Wholesale and Retail Trade Establishments

In terms of the variation that occurs in the volume and pattern of goods movement, wholesale and retail trade establishments were more subject to the vagaries of the consumer cycle and business trends than manufacturers.

The groceries-general line distributors surveyed generated on an average day 25.7 million pounds, or 38.1 percent of the total tonnage handled by all establishments surveyed. The average outbound tonnage handled per day was 11.5 million pounds; the inbound figure was 14.2 million pounds. The average inbound shipment was 62,304 pounds; the average outbound shipment was 25,469 pounds and ranged in size from 13,986 pounds to 140,000 pounds.

The establishments interviewed exhibited tremendous variation in the pattern of goods movement.

The percentage of goods shipped outside the Dallas-Fort Worth economic area ranged from zero to 85 percent. Most of this outbound tonnage was destined for the Texas market and that of the four adjoining states. For example, one

grocery distributor shipped 85 percent to Texas outlets, 1 percent to New Mexico, 3 percent to Oklahoma, 3 percent to Arkansas, and 8 percent to Louisiana.

The goods handled by these distributors originated in many parts of the United States. Many distributors received most of their meat products from Texas processors. Many of the areas noted for a particular product were sources for some of the distributor's products. California, Florida, and the Midwest supplied many of the distributors with fruits and vegetables. Some distributors used Texas-grown products in their operation. Many other grocery items originated in Pennsylvania, Iowa, Michigan, and Ohio.

Unlike the manufacturers surveyed, the grocery distributors experienced daily fluctuation in the pattern of goods movement. Many distributors noted that Monday and Tuesday were heavy days for outbound shipping owing to the accumulation of items over the weekend. Monday and Friday were generally heavy days for inbound shipments. The week prior to the end of a calendar quarter tended to be a period of peak activity as businesses attempted to reduce their inventories and realize some accounting income or profit. Generally the retailing cycle exerts tremendous pressure on this industry.

The beer and ale distributors surveyed handled approximately 1.5 million pounds per day, or .7 million pounds inbound and .8 million pounds outbound. The average inbound shipment was 68,000 pounds; the average outbound shipment was 31,000 pounds.

Neither distributor shipped outside the study area, and nothing was shipped outside the precincts in Dallas that allow the sale of alcoholic beverages.

Both distributors depended on Texas breweries for the bulk of their products. The distributors together received approximately 83 percent of all their beer products from Texas. Breweries located in Missouri, Florida, and

Wisconsin supplied the balance of the products.

The beer and ale distributors faced complex daily and seasonal distribution patterns. Normally Mondays and Tuesdays were basically days of peak outbound activity. Wednesdays were generally the lowest days for outbound shipments, and Fridays were moderate. On a yearly basis April-August was the period of peak activity. The succeeding months were progressively less active, with January being the lowest.

Despite this general pattern, the difference between low and high periods was slight. For example, one manufacturer averaged a 1.5 percentage point difference between peak and low periods, with the peak as a base period of 100 percent.

Survey data show that the photographic equipment and supplies distributor handled approximately 344,800 pounds of goods in a day. The average inbound shipment was 100,000 pounds, and the average outbound shipment was 450 pounds.

This distributor shipped 72 percent of all his output outside the study area. Houston, Oklahoma, and Colorado received 15 percent, 10 percent, and 12 percent of the output, respectively; but generally all of the West South Central states, along with New Mexico, Wyoming, Colorado, Kansas, and parts of Missouri, were served through this distributor.

Most of the incoming freight originated in New York. Ninety-nine percent of all supplies originated in New York, and Colorado was responsible for 1 percent.

This distributor stated that 40 percent of the outbound tonnage for a week is handled on Mondays. Monday was also tagged as a heavy inbound day. On a monthly basis, the end of each month was a period of peak activity. This distributor noticed two peak periods: one in April-July and the other in October-December. Generally January-February was the low period.

The frozen food distributor surveyed average 450,000 pounds per day inbound and outbound. The average inbound shipment was 62,500 pounds; the average outbound shipment was approximately 53,000 pounds.

Fifty percent of all this distributor's tonnage was shipped to points outside the study area. Thirty-eight percent of the outbound goods were destined to other points in Texas, with Houston the single largest recipient. Several of the states east of Texas received 11.5 percent of the tonnage shipped.

The sources for most of the products handled were Texas and the other West South Central states. Most of the meat products came from North Texas processors.

This distributor experienced moderate fluctuation in volume on a daily and seasonal basis. He found, as did many of the other distributors surveyed, that Monday and Tuesdays were the most active days for inbound shipments. For this distributor, Fridays were generally the days of heaviest outbound activity. April-September was a peak period for such items as turkeys and frozen berries.

The general merchandise distributors studied handled around 2 million pounds per day. The average outbound shipment was 12,500 lbs. and the inbound figure was 18,000 lbs.

The market area for these distributors was basically Texas and the four adjoining states. For example, one distributor shipped 7 percent of his goods to outlets in the study area, 65 percent to other points in Texas, 6 percent to New Mexico, 8 percent to Oklahoma, and 11 percent to Louisiana.

The freight handled by these distributors originated in various parts of the United States. One distributor received most of his items from Illinois, New York, and California. Another distributor received 80 percent of all furniture from Washington and the West coast. Ports in Houston, Los Angeles,



and New Orleans were the sources of imported items.

The volume and pattern of goods movement for these distributors were affected by the consumer and retail cycles. One distributor noted that December and January were normally high-volume months for garden tractors because of consumers' tendency to prepare for the gardening period during this time. One distributor found that the periodic seasonal, holiday, or general sale activity greatly affected volume and the pattern of goods movement.

The petroleum products distributors were unable to provide data on all phases of their operation. The distributors reported that they handled around 1.1 million pounds of goods per day, but that figure is misleading because no pipeline volume was provided. The average inbound shipment was 60,000 lbs.

The distribution area for these distributors was basically restricted to North Texas. One distributor delivered all products within a 70-mile radius. The other distributor surveyed delivered no farther than 120 miles from his facility.

All items handled by these distributors originated in Texas. Texas petroleum manufacturers were responsible for all liquid petroleum products as well as packaged items.

There was no substantial variation in volume on a daily or seasonal basis, but the distributors did indicate that gas consumption tends to increase during the warmer months.

The lumber and building material dealer surveyed handled approximately 3.6 million pounds of freight in an average day. The average inbound shipment was 100,000 lbs. and the average outbound shipment was 27,000 lbs.

This dealer shipped 50 percent of all tonnage outside the study area. These outbound shipments were destined to all regions of the United States.

The lumber and other products handled by this dealer originated in the United States. Northern California was the source of most of the redwood. Oregon and Washington were major suppliers of spruce, fir, and cedar. Some fir also came from New Mexico. Texas and parts of Louisiana and Mississippi were major sources of pine. Many imported items were channeled through the Port of Houston.

This dealer found inbound activity heaviest on Fridays and Mondays; the heaviest outbound activity also occurred on these days. Little variation in volume on a yearly basis was noted, but January and February were generally low months.

The general hardware dealer surveyed handled 39,350 lbs. of goods in an average day. The average inbound shipment was 127 lbs. and the outbound figure was 200 lbs.

This dealer shipped 60 percent of his goods to destinations outside the study area. Most of the inbound freight originated in the upper West North Central region and parts of the East North Central and East South Central regions.

This dealer experienced substantial monthly variation in volume. January was normally the heaviest inbound month. February and August were also active months for inbound shipping. The remaining months were periods of constant or steady activity.

The machinery, equipment, and supply dealer interviewed handled 86,364 lbs. inbound on an average day and 90,910 lbs. outbound. The average inbound shipment was 33,217 lbs.

This dealer shipped 75 percent of his output to points in Texas. Oklahoma, Louisiana, and New Mexico received the remaining 25 percent of the output.

Fifty percent of the goods handled by this dealer originated in Indiana. Chicago was the source for 40 percent of the goods handled by this dealer.

This distributor noted some variation in daily volume. Heaviest out-bound activity generally occurred at the end of the week. No substantial variation was noted on a monthly or yearly basis.

An understanding of the degree to which the Dallas-Fort Worth area relies on or is independent of another area can offer some insight into the transportation needs and requirements that must be met.

As the preceding sections indicated, the manufacturers, wholesalers, and retail establishments received and shipped goods, to varying degrees, throughout the United States. By use of data published in the 1967 Census of Transportation it can be determined to what extent other production areas (a term coined by researchers from the Bureau of Census) export to the study area.

There were four major product groups shipped to Dallas from the 24 selected production areas. Of the 3,498.8 thousand tons destined for the Dallas-Fort Worth production area, 30.7 percent was food and kindred products, 17.4 percent chemicals and allied products, 16.5 percent primary metal, and 12.1 percent transportation equipment (see Figure 5). The other industries sent amounts ranging from .07 percent (petroleum products) to 3 percent (lumber and allied products). Another example of the interdependencies of the study area with selected production areas is presented in Table 8.

Figure 5

PERCENTAGE OF GOODS SHIPPED TO DALLAS—FORT WORTH  
PRODUCTION AREA BY INDUSTRY TYPE

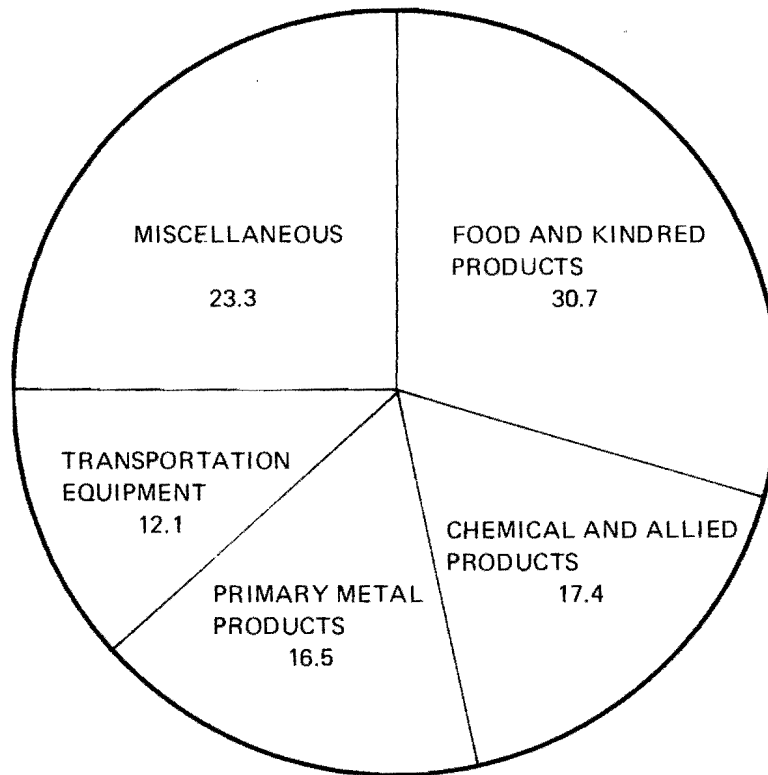
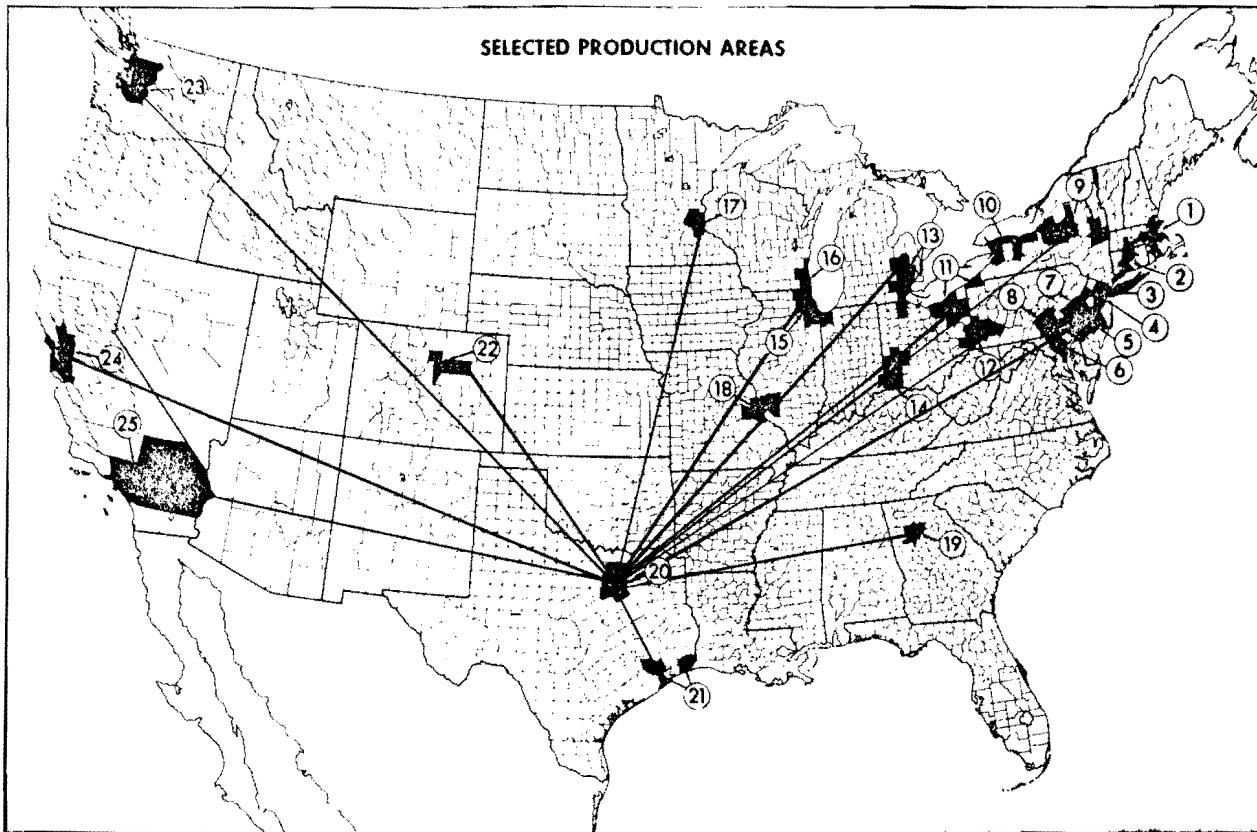


Figure 6

SPATIAL DIFFUSION OF PRODUCTION AREAS RELATIVE TO DALLAS-FORT WORTH



Source: This map was adopted from the 1967 *Census of Transportation-Commodity Transportation Survey*, United States Department of Commerce/Bureau of the Census. For a description of the production areas see that document.

Table 8

PERCENTAGE OF TOTAL OUTPUT FROM SELECTED PRODUCTION AREAS DESTINED FOR DALLAS-FORT WORTH

Area	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	21	22	23	24	25
Dallas-Fort Worth	0.2	0.7	1.0	0.4	0.7	0.4	0.1	0.9	0.3	0.5	0.5	0.3	0.6	0.8	0.8	1.2	1.1	1.6	0.6	0.6	2.6	0.1	0.5	0.7

Source: *Census of Transportation 1967-Commodity Transportation Survey*, United States Department of Commerce/Bureau of the Census.

## CHAPTER V

### EVALUATION OF CARRIER SERVICE

#### Introduction

The data presented in this report are at best only suggestive. Use of such data for comparison of the efficiency or inefficiency of services provided by one type of carrier and that provided by another is difficult. This difficulty arises not only from the lack of comparable data but also from the problem of defining efficiency exactly.

In this section several variables are utilized in evaluating the service provided by private, contract, and motor common carriers. This researcher has chosen to use the following components of a firm's demand for transportation, presented in a book that might be rated a tour de force in the area of transportation,<sup>7</sup> as elements to observe in assessing service provided by a particular carrier: (1) spatial distribution of the receiver and shipper, (2) volume of shipments, (3) distance and weight profile, (4) regularity of shipments, (5) speed or transit time of movement, (6) split deliveries or pickups, (7) damage to deliveries, and (8) night deliveries.

All the components presented are not applicable in this study because of research methods and intent. The initial research project was designed to be an inventory of existing freight transportation facilities, service, policies, and practices of major users of transportation in the study area. Thus, qualitative or quantitative assessments of such factors

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<sup>7</sup>Walter Y. Oi and Arthur P. Hurter, Economics of Private Truck Transportation, (William C. Brown Company for the Transportation Center for Northwestern University, 1965), pp. 32.

as waiting time and damage to deliveries and several of the other components are impossible, since this type of information was not specifically sought. All those components enumerated that can be quantitatively or qualitatively dealt with, however, are discussed in this report.

The 41 manufacturers and wholesale and retail establishments surveyed were basically private carriers. Private carriers made up 65.9 percent of the establishments surveyed. The common motor carrier was the major transporter for 26.8 percent of the businesses surveyed and contract carriers were used by 7.3 percent of the establishments.

Merely attaching the title "private carrier", "common carrier", or "contract carrier" to the transportation system used by an establishment is not completely descriptive. In no instance did researchers find one type of carrier handling all outbound or inbound shipments, a situation easily explained by the certification privileges currently available. In summary, the terms private, contract, or common carrier only describe the system generally used by a business or the permits held by it.

In the analysis of a firm's demand for transportation, use of the eight factors enumerated previously is tantamount to determining why one carrier is preferred over another in a given situation. Therefore a carrier is evaluated and rated as efficient or inefficient depending on how adequately these demands are met.

#### Private Carriers

In terms of the spatial distribution of receiver and shipper (distributor), distance and weight profile, and regularity of shipments over time, the private carrier seemed to have met the transportation needs of most of the businesses surveyed.



The 77 manufacturers and nonmanufacturers operating private fleets tended to use them for local deliveries or limited long hauls. This situation was determined by the large number of wholesale and retail trade establishments operating private fleets (59.3 percent of all private carriers fell into this group). Basically the business of these distributors was local, with some regular service to the adjoining states. For this type of requirement, a reliable source of transportation was needed, and presumably the private carrier operation meets this need to a certain degree. The manufacturers operating private fleets had some local deliveries, but far fewer than the wholesale and retail trade distributors. Generally the manufacturers utilized common carrier and rail for shipping over extremely long distances. In terms of inbound shipping, both manufacturers and distributors used private carriers less (in some cases not at all) and common carrier and other modes more.

Several private carriers found it advantageous to utilize common carrier for LTL shipments and to discontinue operation of their units beyond a certain point. This phenomenon illustrates the influence of economic considerations upon the choice of carrier. One carrier indicated that LTL shipments were given to common carriers, while volume loads were carried on company trucks. No general trend was visible, but one company used common carriers for shipments to points farther than 50 miles from its facility.

In assessment of the overall private carrier operation, it might be said that those establishments maintaining private fleets gain and lose because of it. The gain results from the regularity and dependability of a self-operated transportation system. The loss occurs because many private carriers cannot realize the economies of scale of larger operations; they cannot always justify hauling LTL units and delivering over long distances because the costs are prohibitive.

In terms of the spatial diffusion of receiver and shipper and the distance and weight profile, the use of common carrier by 11 businesses was justified.

### Motor Common Carriers

The eleven operations utilizing common carrier for the bulk of their shipping were basically national distributors. The range for the percentage of goods shipped outside the Dallas-Fort Worth area was from 65 percent to 99.5 percent. Most of the shipments were full loads, sometimes achieved by pooling of orders, and interstate freight.

In summary, the common carrier service provided to these 11 operations did offer some advantage to the user. The distance and weight profile is probably the main factor favoring the use of common carrier. Further, since most of the shipments were full loads, the shipper was able to take advantage of quantity discounts.

### Contract Carriers

Contract carriers, used by three operations surveyed, possess some of the advantages of private carriers. In terms of regularity of shipments over time and reliability, these operations realized no less of an advantage by using contract carrier than by operating their own units.

Further, the use of contract carriers relieved many operations of the need to own expensive specialized equipment that would generally be underutilized. For example, one manufacturer required a large number of special units because of the dimensions and weight of the item carried. To meet his need, this manufacturer utilized specialized contract carriers. This decision was wise, not only for the reason cited above, but also because the bulk of all shipping was done by rail and the pace of business activity did not justify maintaining and operating a fleet of special equipment. For this particular manufacturer, inventories might turn as often as every six months or as infrequently as every one and one-half years.

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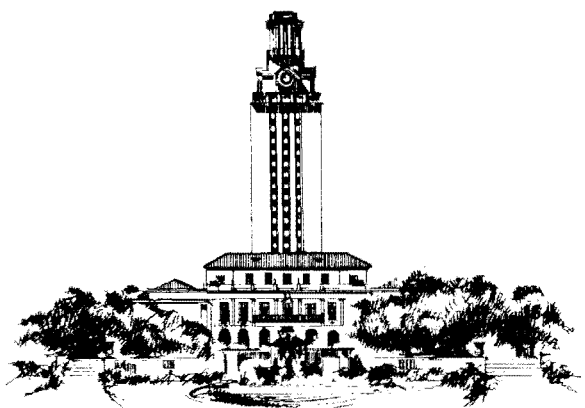
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